UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

✦

Manual of First-Aid Instruction

UNITED STATES DEPARTMENT OF THE INTERIOR

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BUREAU OF MINES

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CONTENTS

	Page
Preface	XVII
Introduction	1
Bureau of Mines first-aid training	1
Cooperative first-aid training	2
Rules governing Bureau of Mines training in first aid	3
Rules governing Bureau of Mines cooperative training in first aid	4
Provisional first-aid instructor	4
Renewals of provisional first-aid instructor's card certificate	5
Permanent first-aid instructor's engraved certificate and card certificate	5
Regulations for the examination of cooperatively trained first-aid classes	5
First aid	6
One-hundred-percent cooperative training in first aid	8
First-aid organization	9
First-aid equipment	11
Dressing stations	11
First-aid cabinets	11
Surface emergency hospital	12
General directions for rendering first aid	15
Outline of Bureau of Mines standard first-aid course	16
Anatomy of the human body	31
The skeleton	31
Joints	35

Anatomy of human body—Continued. Page
Muscles and tendons 37
The skin 37
The chest cavity and its contents 37
The abdominal cavity and its contents 39
Excretory systems 39
First-aid dressings 40
Bandages 40
Triangular bandages 40
Cravat bandages 42
Reef or square knot 42
Bandage compress 42
Gauze 44
Splints 44
Slings 46
Triangular bandage sling 46
Cravat bandage sling 46
Tourniquets 48
Respiration 48
Lungs 50
Artificial respiration 52
How to give artificial respiration by prone-pressure method 54
Change of operators 57
How to give artificial respiration by Sylvester method 57
Administration of oxygen 59
Electric shock 60
Dangerous gases 61
Methane 61
Carbon dioxide 61
Sulfur dioxide 62
Oxides of nitrogen 63
Ammonia 63
Hydrogen sulfide 63
Carbon monoxide 64

Dangerous gases—Continued. Page
Hydrogen cyanide gas and cyanogen gas compounds 65
Prevention of gas poisoning 66
Treatment of gas poisoning 66
Drowning 67
Suffocation or asphyxiation 67
Circulatory system 68
Blood supply 68
Heart 68
Blood vessels 68
Purification of blood by the lungs 70
Hemorrhage or bleeding 70
Methods of controlling bleeding 75
Arterial bleeding 75
Application of tourniquets 77
Arteries and pressure points 81
Internal bleeding 84
The nervous system 84
Physical shock 86
Causes of physical shock 86
Symptoms of physical shock 86
Appearance of patient 86
Examination of patient 87
Treatment of physical shock 88
Shock where face is flushed or red and pulse is full and strong 91
Shock where face is pale and pulse is rapid and weak 92
Shock where face is blue and pulse is usually rapid and weak 92
Fainting 92
Symptoms 92
Treatment 93
Heat exhaustion 93
Symptoms 94
Treatment 94

	Page
Heat cramps	94
Sunstroke	95
Symptoms	95
Treatment	96
Apoplexy	96
Symptoms	97
Treatment	97
The skin	97
Infection	98
Open wounds	99
Abrasions	99
Incised wounds	99
Lacerated wounds	100
Punctured wounds	100
General directions for care of open wounds	100
Precautions against infection of wounds	101
Bandaging	102
Dressings for wounds and bleeding	102
Extensive wounds and bleeding of scalp	102
Wound and bleeding of scalp, temple, ear, or face	104
Wound and bleeding of forehead or back of head	104
Injuries of eye	104
Wound and bleeding of nose	107
Wound and bleeding of chin	108
Wound and bleeding of neck or throat	109
Wound and bleeding of shoulder	109
Wound and bleeding of armpit	109
Arm torn from body	111
Dressing for amputated arm	111
Wound and bleeding of arm	113
Wound and bleeding of elbow	114
Wound and bleeding of forearm	114
Wound and bleeding of wrist	114
Wound and bleeding of palm of hand	116

Dressings for wounds and bleeding—Continued. Page
Wound and bleeding of back of hand 116
Extensive wounds and bleeding of hand 116
Wound and bleeding of finger 118
Wound of end of finger 118
Wound and bleeding of back between shoulders 120
Wound and bleeding of chest between shoulders 120
Wound and bleeding of back, chest, abdomen, or side 123
Wound and bleeding of lower part of abdomen, lower part of back, or buttocks 123
Wound and bleeding of groin 125
Wound and bleeding of crotch 125
Wound and bleeding of hip 125
Wound and bleeding of thigh 128
Dressing for amputated thigh or leg 129
Wound and bleeding of knee 130
Wound and bleeding of leg 130
Bleeding from varicose veins in leg 130
Wound and bleeding of ankle or foot 133
Extensive wounds and bleeding of foot 133
Wound and bleeding of toe 133
Wound of end of toe 134
Burns and scalds 134
Treatment for burns and scalds 135
Chemical burns 137
Burns of eye by chemicals 137
Burns of face, head, or neck 138
Burns of shoulder 138
Burns of arm 140
Burns of forearm 140
Burns of hand 140
Burns of back 140
Burns of chest 144
Burns of lower abdomen, lower back, and buttocks 144
Burns of hip 144

Page

Burns and scalds—Continued.
Burns of thigh 144
Burns of leg 146
Burns of foot 146
Composite burns of head, face, neck, body, and extremities 146
Closed wounds 146
Bruises 146
Treatment 148
Strains 148
Treatment 148
Sprains 149
Treatment 149
Dressing for a sprained ankle 150
Rupture or hernia 150
Treatment 151
Foreign bodies in eye 153
Foreign bodies in ear 154
Foreign bodies in nose 155
Foreign bodies in the throat or windpipe 155
Foreign bodies in stomach 156
Dislocations 156
Dislocation of lower jaw 157
Dislocation of shoulder 158
Dislocation of elbow 160
Dislocation of wrist 162
Dislocation of finger 162
Dislocation of hip 165
Dislocation of knee or kneecap 167
Dislocation of ankle 167
Dislocation of toe 169
Fractures 169
Placing bandages for splints 171
Fracture of skull 172
Fracture of nose 172
Fracture of upper jaw or cheekbone 173

Fractures—Continued. Page
Fracture of lower jaw 173
Fracture of collarbone 173
Fracture of shoulder blade 174
Fractures of upper extremity where fixed traction is not applied 177
Fracture of upper third of arm 177
Fracture of lower two-thirds of arm, elbow, forearm, or wrist 177
Fracture or crushing of bones of hand or fingers 179
Fracture of finger 181
Fracture of rib 181
Fracture of spine 183
Broken neck 185
Broken back 188
Fracture of pelvis or hip 190
Fracture of the lower extremity where fixed traction is not applied 191
Fracture of the thigh, knee, or ankle 193
Fracture of kneecap 193
Fracture of leg 195
Fracture or crushing of bones of foot or toes 195
Fixed traction in applying splints for fractures of the long bones of the extremities 196
Fixed traction in splinting fractures of upper extremity 197
Fixed traction in splinting factures of lower extremity 201
Bureau of Mines general-utility splint stretcher 206
Poisons 207
Prevention of poisoning 208
Poisoning by mouth 208
Corrosive poisons 209
Treatment for corrosive poisons 210
Carbolic acid or lysol poisoning and its treatment 210

Fig.		Page
4.	The skeleton	32
5.	The spinal column and section through several vertebrae	33
6.	The pelvic basin	34
7.	The surface muscles of the body	36
8.	The chest and the abdominal cavities and their contents	38
9.	Method of folding cravat bandages	41
10.	Method of tying reef knot or square knot	43
11.	Bandage compress	45
12.	Arm slings	47
13.	Nose, throat, trachea, and gullet	49
14.	The lungs	51
15.	Artificial respiration, prone-pressure method	55
16.	The chest cavity and lungs in prone-pressure method of artificial respiration	56
17.	Artificial respiration, Sylvester method	58
18.	Systemic and pulmonary circulation	69
19.	Course of arteries and pressure points	71
20.	Course of arteries and pressure points: Head and neck	73
21.	Course of arteries and pressure points: Upper extermity	74
22.	Course of arteries and pressure points: Lower extremity	76
23.	Improvised tourniquet applied to arm	79
24.	Pressure points	80
25.	Dressing for extensive wounds of scalp	103
26.	Dressing for wounds of scalp, temple, ear, or face	105
27.	Dressing for wound of forehead	106
28.	Dressing for injury of eye	106
29.	Dressing for wound or fracture of nose	107
30.	Dressing for wound of chin	107
31.	Dressing for wound of neck or throat	108
32.	Dressing for wound of shoulder	110

Fig.		Page
33.	Dressing for wound of armpit	112
34.	Dressing for wound of arm	113
35.	Dressing for wound of elbow	115
36.	Dressing for wound of forearm	115
37.	Dressing for wound of palm of hand	117
38.	Dressing for wound of back of hand	117
39.	Dressing for extensive wounds of hand	119
40.	Dressing for wound of finger; compress over end of finger and dressing complete	121
41.	Dressing for wound of back between shoulders	121
42.	Dressing for wound of chest between shoulders	122
43.	*A*, Dressing for wound of back, chest, or abdomen, using a wide cravat bandage; *B*, dressing for wound of side, using a wide cravat bandage	124
44.	Dressing for wounds of lower part of abdomen, lower part of back, or buttocks using spliced triangular bandages	126
45.	Dressing for wound of groin	126
46.	Dressing for wound of crotch	127
47.	Dressing for wound of hip	128
48.	Dressing for wound of thigh	128
49.	Dressing for wound of knee	129
50.	Dressing for wound of leg	131
51.	Dressing for wound of ankle or foot	132
52.	Dressing for extensive wounds of foot	132
53.	Dressing for burns of face, head, and neck	139
54.	Dressing for burns of arm	141
55.	Dressing for burns of forearm	142
56.	Dressing for burns of back and shoulders	143
57.	Dressing for burns of chest and shoulders	145
58.	Dressing for burns of head, face, neck, body, and extremities	147
59.	Dressing for sprained ankle	151
60.	Dressing for rupture	152

Fig.		Page
61.	Dressing for dislocation or fracture of lower jaw	159
62.	Dressing for dislocation of shoulder	161
63.	Dressing for dislocation of elbow, using straight splint	163
64.	Dressing for dislocation of elbow, using L-shaped splint	164
65.	Dressing for dislocation of hip	166
66.	Dressing for tying arms together of an unconscious patient for transportation	168
67.	Dressing for fracture of collarbone	175
68.	Dressing for fracture of shoulder blade	176
69.	Dressing for fracture of upper third of arm	178
70.	Dressing for fracture of lower two-thirds of arm, elbow, forearm, or wrist	180
71.	Dressing for fracture or crushing of bones of hand or fingers	182
72.	Dressing for fracture of ribs	184
73.	Dressing for fracture of neck	187
74.	Dressing for fracture of back	189
75.	Dressing for fracture of pelvis, using broken-back splint	192
76.	Dressing for fracture of thigh, knee, or ankle	192
77.	Dressing for fracture of kneecap	194
78.	Dressing for fracture of leg, showing use of extra bandage	194
79.	Dressing for fracture or crushing of bones of foot or toes	196
80.	Dressing for fracture of upper extremity by fixed traction, using Murray-Jones prepared splint	199
81.	Dressing for fracture of upper extremity by fixed traction, using wood splint	200
82.	Dressing for fracture of lower extremity by fixed traction, using Keller-Blake prepared splint	203
83.	Dressing for fracture of lower extremity by fixed traction, using wood splint	205
84.	Carrying in arms	232
85.	Moving or dragging patient; use of cravat bandage	234

Fig.		Page
86.	Moving or dragging patient; patient's wrists tied together	235
87.	Carrying astride back	237
88.	Two-man: Assisting to walk	238
89.	Two-handed seat carry: Position of bearers' hands and arms	239
90.	Two-handed seat carry: Carrying patient	240
91.	Preparing to lift patient in carrying by extremities	242
92.	Carrying patient by extremities	243
93.	Three-man carry: Preparing to lift patient	244
94.	Three-man carry: Patient resting on bearers' knees	245
95.	Three-man carry: Patient in position to carry	246
96.	Army stretcher	248
97.	Stokes Navy stretcher	248
98.	Making improvised stretcher from coats or jackets	249
99.	Improvised stretcher from coats or jackets completed	250
100.	Improvised blanket stretcher, partly folded	250
101.	Bureau of Mines general utility splint stretcher	251
102.	Homestake splint stretcher	251
103.	Jarrett splint stretcher	252
104.	Portable splint stretcher	252
105.	Crew in line for stretcher drill, No. 3 having obtained the stretcher	254
106.	Stretcher drill: Carrying stretcher	256
107.	Stretcher drill: Preparing to lift patient	258
108.	Stretcher drill: Pateint resting on bearers' knees; stretcher placed in position	259
109.	Stretcher drill: Lowering patient	260
110.	Stretcher drill: Lifting stretcher	262
111.	Stretcher drill: Carrying patient	263
112.	Stretcher drill: Post to load ambulance	265
113.	Diagram of stretcher drill	266

PREFACE

The act of Congress establishing the Bureau of Mines delegated to the Bureau as one of its principal duties and functions the study of health and safety in the mineral industries with a view to devising and putting into operation means of conserving the health and safety of those employed therein.

Investigations conducted during the earlier years of the Bureau demonstrated the urgent need for prompt, correct emergency care of those injured, especially in mines, as near as possible to the locality where the injury was incurred. Due to lack of such emergency treatment, some of the injured frequently suffered long periods of disability and others died from severe hemorrhage, asphyxiation, fractures, and shock.

One of the first health and safety activities of the Bureau of Mines was, therefore, organization of a trained force to promote instruction in first aid in the mineral industry. Recognizing that such instruction must be given in simple English and primarily from a lay standpoint, the Bureau wisely delegated it to men who were not doctors primarily, but who had been thoroughly trained under medical supervision.

In the early days the training work was retarded by lack of suitable first-aid publications. To overcome this handicap and to provide handbooks best suited to the persons to be trained, six different publications have been issued by the Bureau of Mines, including the present edition of the Manual of First-Aid Instruction.

The following publications of the Bureau of Mines have been used in first-aid instruction to date:

Miners' Circular 8. First-Aid Instructions for Miners, by Dr. M. W. Glasgow, W. A. Raudenbush, and C. O. Roberts, 1913, 67 pages, 51

illustrations. Many editions were issued, and it served as a text for training purposes until 1917.

Miners' Circular 23. Elementary First Aid for the Miner, by Dr. W. A. Lynott and D. Harrington, 1916, 24 pages, 19 illustrations. This was printed in English, Italian, Polish, and Slovak.

Handbook. Advanced First-Aid Instructions for Miners, by Dr. G. H. Halberstadt, Dr. A. F. Knoefel, Dr. W. A. Lynott, Dr. W. S. Rountree, and Dr. M. J. Shields, 1917, 142 pages, 65 illustrations. This was the first complete textbook for industrial first-aid instruction published in the United States.

Handbook. Manual of First-Aid Instruction for Miners, a revision of the previous handbook, by Dr. R. R. Sayers, 1921, 206 pages, 99 illustrations.

Handbook. Manual of First-Aid Instruction, a revision of the Manual of First-Aid Instruction for Miners, by Dr. R. R. Sayers, Dr. L. A. Shoudy, and G. W. Grove, 1930, 221 pages, 107 illustrations.

The present revision simplifies descriptions of injuries and their dressings and includes first-aid methods that have been found by everyday application in industry to provide satisfactory care for the injuries for which they are recommended.

There are a number of excellent first-aid manuals, but most of them differ to some extent in the manner of caring for injuries or in applying dressings. Although these differences are not vital, they often are confusing in contest work. The Bureau of Mines has found that such first-aid contests are valuable in promoting and maintaining interest in first aid.

The practice required for contests adds much to perfecting of the first-aid understanding and technique of members of first-aid teams. For the instruction and successful conduct of first-aid meets a standard of first-aid methods must be established and maintained. This revision of the Manual of First-Aid Instruction has therefore been made with the idea of standardizing first-aid procedure in all industries served by the Bureau of Mines for both general first-aid instruction and contest work.

To make the present manual as complete and helpful as possible, 1,000 questionnaires were distributed to members of the Health and Safety Branch of the Bureau of Mines in every

section of the United States, who in turn circularized industrial physicians, safety engineers, and first-aid instructors in the mineral industries throughout their districts. Each questionnaire provided space for suggestions as to changes or corrections in the revision of the 1930 Manual of First-Aid Instruction and for new material that should be included in the revised manual.

Many helpful suggestions were received from men with years of experience in giving instruction in first aid and supervising the daily application of first aid in industries employing thousands of workers.

The committee on revision gratefully acknowledges the cooperation of the industrial physicians, safety engineers, first-aid instructors, and employees of the Health and Safety Branch who have furnished many of the constructive changes incorporated in the present Manual of First-Aid Instruction.

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MANUAL OF FIRST-AID INSTRUCTION [1]

INTRODUCTION

First-aid training for those employed in the mineral industries has been an important activity of the Bureau of Mines since it was established in 1910. Through the personnel of its safety stations and cars in 15 States and Alaska the Bureau maintains continuous contact with employees of the mining, metallurgical, petroleum, and quarrying industries. By instruction and demonstrations information is disseminated regarding safe and unsafe practices, with a view to reducing avoidable accidents as well as teaching the correct emergency aid of injured persons until medical care can be obtained.

During the fiscal year 1938, 102,698 employees of the mineral industries received the Bureau of Mines standard training in first aid, and since the establishment of the Bureau more than a million have received first-aid training.

BUREAU OF MINES FIRST-AID TRAINING

The Bureau of Mines standard first-aid course requires a minimum of 15 hours of instruction and practical work, exclusive of a period devoted to the examination of class members on completion of the course. The usual practice is to divide the course into five 3-hour periods. Where the time devoted to each period must be shortened, the number must be increased

[1] Work on manuscript completed April 1939.

to cover the full 15 hours so that all of the subject matter of the course may be completed. Each period comprises a short lecture and a review of the work of the previous period followed by demonstrations and practice work by the entire class. Those who complete the course for the first time and show by oral and practical examination that they are properly qualified are furnished by the Bureau of Mines instructor with a pocket card certificate, and a large, engraved, first-aid certificate suitable for framing is sent to them by the Bureau of Mines.

Those who are retrained later in the standard first-aid course and pass a satisfactory examination receive a pocket card certificate showing that they have completed additional first-aid training, but they do not receive a second large certificate.

COOPERATIVE FIRST-AID TRAINING

In 1926 the Bureau of Mines initiated cooperative first-aid training, by which mines or plants could have their entire personnel trained in first aid in a single campaign within a few weeks. Many mines and plants have taken advantage of the cooperative plan.

With the aid of operating officials, a group of keymen in a plant or a mine is given intensive training in first aid for 2 weeks by a Bureau of Mines instructor. Those of the group who evince a thorough knowledge of first aid and an aptitude for teaching it are selected as tentative provisional first-aid instructors. To qualify, they must train a class of at least 10 persons employed in the mineral industries in the standard Bureau of Mines course in first aid, under the supervision of a Bureau of Mines instructor. When a tentative provisional first-aid instructor's class has been examined by the Bureau of Mines instructor and found to be properly trained, a provisional first-aid instructor's pocket card certificate, which is good for 1 year, is issued to the class instructor.

During each 12 months following the issuance of his original card certificate the provisional first-aid instructor may renew his provisional first-aid instructor's annual pocket card certificate upon completing the training or retraining of a class of at least 10 persons connected with the mineral industries, the members of which have passed satisfactorily an examination given by a Bureau of Mines representative. After five yearly renewals of his provisional instructor's pocket card certificate, the instructor receives a large engraved permanent instructor's certificate and a permanent instructor's pocket card certificate.

When a mine, plant, or company of the mineral industries completes the training of its entire personnel in the Bureau of Mines standard first-aid course, a large, engraved certificate is issued to the plant, mine, or company showing that 100 percent of the employees have been trained in first aid to the injured.

RULES GOVERNING BUREAU OF MINES TRAINING IN FIRST AID

1. To be eligible for a Bureau of Mines card and a large, engraved, first-aid certificate, the recipient must be employed in some branch of the mineral industries, or be a member of the family of an employee in the mineral industries, and be at least 16 years of age.

2. All courses in first aid must conform to the Bureau of Mines standards and must be supervised by an authorized Bureau of Mines representative.

3. The Bureau of Mines Manual of First-Aid Instruction will be the text book for instruction purposes.

4. The Bureau of Mines instructor's outline of the standard first-aid course must be followed, and not less than 15 hours of instruction and practical work must be given.

5. All examinations for first-aid certificates must be given by an authorized Bureau of Mines representative and must conform to Bureau of Mines standards.

RULES GOVERNING BUREAU OF MINES COOPERATIVE TRAINING IN FIRST AID

PROVISIONAL FIRST-AID INSTRUCTOR

1. Before an applicant can be recommended for a provisional first-aid instructor's card, he must have completed the Bureau of Mines standard first-aid course and have a first-aid certificate issued by the Bureau of Mines, or have been recommended for such a certificate, which is in the course of preparation.

2. The applicant must train a class of at least 10 persons connected with the mineral industries in first aid in accordance with the Bureau of Mines prescribed first-aid course; the members of such a class, on examination by a representative of the Bureau of Mines, must be found qualified and eligible for first-aid certificates. Bureau of Mines representatives only are authorized to examine classes, issue and sign first-aid card certificates, and recommend members of a provisional instructor's class for large, engraved, Bureau of Mines first-aid certificates.

3. When instructing classes the applicant must have delivered all of the lectures personally and demonstrated all of the dressings, in accordance with the Bureau of Mines standard first-aid course. Persons who only assist a provisional instructor in conducting classes cannot be recommended for provisional first-aid instructors' cards.

4. When an applicant has met the requirements, the Bureau of Mines representative conducting the examination recommends that a provisional first-aid instructor's card certificate be issued.

5. The provisional first-aid instructor's card certificate is effective for 1 year from date of issue.

6. Classes taught by provisional first-aid instructors shall be limited to 20 persons; 18 are preferable.

RENEWALS OF PROVISIONAL FIRST-AID INSTRUCTOR'S CARD CERTIFICATE

1. The applicant must train or retrain a class of at least 10 persons connected with the mineral industries, who, on examination by a representative of the Bureau of Mines, are found to be satisfactorily instructed and eligible for the Bureau of Mines first-aid certificates. This will renew the provisional instructor's card certificate for 1 year from the date of examination of the class.

2. No provisional first-aid instructor's card certificate will be renewed more often than once every 12 months.

3. Renewals of provisional first-aid instructors' card certificates will not be made for training conducted, or classes instructed, unless such classes have been examined by a Bureau of Mines representative at the time the course was completed or shortly thereafter.

PERMANENT FIRST-AID INSTRUCTOR'S ENGRAVED CERTIFICATE AND CARD CERTIFICATE

When a provisional first-aid instructor has duly qualified for the fifth renewal in accordance with the requirements, a large, permanent, engraved first-aid instructor's certificate and a permanent card certificate, requiring no further renewals, will be issued.

REGULATIONS FOR THE EXAMINATION OF COOPERATIVELY TRAINED FIRST-AID CLASSES

1. When the first-aid training has been conducted by a company instructor under the supervision of a Bureau of Mines representative the latter shall devote at least 2 hours to examination of a group.

2. When the training has been conducted solely by a company instructor, not under the supervision of a Bureau of Mines representative, the latter shall devote at least 3 hours to the examination of a group.

3. In every instance the Bureau's standard course of training (whether the training is initial or additional), covering at least 15 hours, must be completed before an examination is held by a Bureau representative.

4. The maximum number examined at one time for initial first-aid certificates shall not exceed 25 persons, or 40 persons if all are being examined for additional first-aid certificates. A mixed group taking initial and additional training shall be considered as taking initial training only and examined accordingly, unless it is feasible to separate the two types.

5. All examinations shall consist of thorough questioning and demonstrations of dressings by the individual members of the group examined.

6. To qualify for a certificate or additional training card, any group or individuals of a group failing to pass satisfactorily an examination for either initial or additional training will be required to take further training until they can pass the examination.

7. When classes that have been retrained annually three or more times are being examined, the class members may be divided into teams, first-aid problems assigned to them, and questions asked the members; however, the time devoted to the examination and the number of persons per group shall be followed as indicated above.

FIRST AID

First aid is the emergency care of a person who is injured or ill, to prevent death or further injury, to relieve pain, and to counteract shock until medical aid can be obtained.

The imperative need of first aid for many injuries where medical aid is not immediately available makes it the duty of

everyone to be able to render proper assistance until a doctor arrives or until the injured person can be taken to a doctor.

Even today, as in its inception, the instruction in first aid given by the Bureau of Mines has its limitations. First aid is never taught for the purpose of replacing the physician or surgeon but only to protect the patient until medical or surgical aid can be obtained. One of the first tenets taught first-aid men is to send for medical aid in all cases of serious injury and even in minor injuries to have the patient see a physician as soon as possible.

If first aid is rendered properly, wounds are protected from infection, fractures are immobilized, loss of blood usually can be checked, natural breathing may be restored in many instances, shock can be prevented or moderated, and pain lessened; thus the patient's strength is conserved; and when medical aid can be obtained, his chance of recovery is greatly enhanced.

The principal objects of first aid are: (1) Prevention of further injury; (2) checking conditions known to be endangering life; (3) protecting injuries from infections and complications; (4) making the patient as comfortable as possible to conserve his strength; and (5) where required, transportation to medical assistance in such a manner as not to complicate the injury or subject the patient to any more discomfort than is absolutely necessary.

Experience of the Bureau of Mines has shown repeatedly that first-aid training is an essential means of promoting safety as well as of saving life. The beneficent influence of the training spreads in many directions.

To the employee:

He is trained to care properly for injuries to himself and to others, during the course of his employment, at home, and elsewhere.

He is made safety-minded and less liable to be injured, because the training inculcates the factor of personal safety through acquaintance with the dire results of injuries.

He is taught that even the most trivial injuries are potential sources of danger and therefore takes fewer chances of permitting wounds to become infected.

He is stimulated to have due regard for fellow employees, both as to their safety and the proper care for injuries they may receive.

To employers:

Those trained in first aid become safer integral parts of the working force, thus lowering the accident experience rate.

Better care for injured employees at the critical time is afforded in proportion to the number trained and their placement among the working force.

Lost time due to accidental injuries is reduced and efficiency increased.

Compensation and medical costs are smaller, thus helping to produce dividends.

Furthermore, the experience of the Bureau of Mines to date shows that with 100-percent training of mine personnel in first aid, the intermingling of the men, the bosses, and the plant or mine officials in classes where everyone is on a common footing and has a common interest in a humane endeavor creates better feeling and understanding between the men in general and their company. It propagates a spirit of mutual protection and regard for the well-being of all among the supervisory and working forces.

ONE-HUNDRED-PERCENT COOPERATIVE TRAINING IN FIRST AID

Cooperative first-aid training by which the entire personnel of a mine or plant is given training increases the above-mentioned benefits proportionately; and it is believed that the maximum benefits are obtained where such training is maintained over a period of years.

FIRST-AID ORGANIZATION

To make first aid a success and to render it most effective necessitates the interest, cooperation, and unqualified support of all workers as well as of the owners, operators, physicians, superintendents, safety engineers, foremen, and assistant foremen.

The owners or operators can be of great assistance by providing a convenient meeting room and fitting it with first-aid materials and equipment for training purposes, as well as by keeping a suitable supply of first-aid materials reasonably close to working places at all times. The company physicians can aid by arranging lectures and acting as medical advisers in first-aid instruction. Superintendents, safety engineers, foremen, assistant foremen—in fact, all in supervisory authority—can assist by encouraging men to take the first-aid training and by attending and taking an active part themselves.

The fact must never be forgotten that to reap the full benefit from first aid it must extend beyond the actual giving of assistance to injured persons and make itself felt in the larger field of the prevention of the occurrence of such injuries. It should be kept in mind that a man well trained in first aid is very likely also to be a good worker for safety in and about the mine or plant.

One of the best ways by which first-aid training may be made to pay dividends in the form of accidents prevented is to organize a safety society, such as a local chapter of the Holmes Safety Association, to train members in first aid, mine rescue, and the prevention of accidents and to provide opportunities and facilities for educational, social, and recreational activities. Full information regarding the work of the Holmes Safety Association and details as to how to organize a local chapter may be obtained by writing to the Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa.

FIGURE 1.—Underground first-aid dressing station.

FIRST-AID EQUIPMENT

DRESSING STATIONS

First-aid dressing stations should be established at all plants and mines at suitable places convenient to all employees. At large mines it has been found advisable to have first-aid dressing stations underground near the bottom of the shaft or slope or on working levels adjacent to good manways (see fig. 1). On the surface at a mine the first-aid dressing station should be near the mine opening or manway.

An emergency dressing station should be equipped with a stretcher, two woolen blankets, a waterproof blanket, a supply of splints, and adequate dressings; all supplies except the splints should be protected from moisture and air in a sealed metal container or its equivalent and kept reasonably clean. There should also be a supply of individual first-aid packets containing:

1 sterilized 40-inch triangular bandage.
1 sterilized 2-inch bandage compress.
2 sterilized 1-inch bandage compresses.
1 square foot of picric-acid gauze, folded.
1 inhalant ampoule of aromatic spirits of ammonia.

These dressings should be in germ-proof wrappings packed in a sealed metal box.

FIRST-AID CABINETS

First-aid cabinets with suitable first-aid material to permit care of all injuries should be distributed about the plant or mine within easy access to employees (see fig. 2).

The type of cabinet found by the Bureau of Mines to be well suited for general use is a metal container 19 inches long by 13 inches wide and 3½ inches deep, with a hinged, tight-

fitting lid. The contents of the first-aid cabinet in unit packages is as follows:

24 sterilized, 40-inch, triangular bandages.
12 sterilized, 1-inch, bandage compresses.
32 sterile, 1-inch, adhesive compresses.
16 sterilized, 2-inch, bandage compresses.
8 sterilized, 4-inch, bandage compresses.
5 packages of sterile gauze, 1 yard square, folded.
5 packages of sterile, picric-acid gauze, 1 yard square, folded
4 packages of ampoules of aromatic spirits of ammonia for internal use.
2 packages of inhalant ampoules of aromatic spirits of ammonia.
12 paper cups (open, nested).
2 Army tourniquets.
1 pair of dressing scissors.
1 pair of tweezers.
6 splints of yucca or similar material

Additional material should be added to the first-aid cabinets only on recommendation of the mine or plant surgeon.

Many mines place combination splints and stretchers throughout the underground workings. These combination units can be constructed at moderate cost and will take care of the immobilization of many of the more serious fractures and dislocations, as well as serve the purpose of a stretcher. (See illustrations under Transportation, pp. 231 to 266.)

SURFACE EMERGENCY HOSPITAL

Where a large number of men are employed, a small emergency hospital building should be available. This building should be situated at a place most convenient to the majority of the workers. Facilities should be provided for thorough examination of patients and complete dressing of injuries. One or more rooms should be furnished with beds where seriously injured persons can be cared for and shock treated until they can be moved with safety. Doctors and nurses can be in constant attendance or subject to call (see fig. 3).

FIGURE 2.—Bureau of Mines first-aid cabinet: *A*, Closed; *B*, open.

FIGURE 3.—Emergency hospital and dressing station.

GENERAL DIRECTIONS FOR RENDERING FIRST AID

When a person is injured someone should take charge, send for a doctor, and render first aid. In the past many deaths have resulted because no one present was trained to treat the injured person. To prevent such neglect every employee should acquire a knowledge of first aid.

The person assuming charge should make a careful examination to determine the nature of the injuries received. When fully satisfied as to the injuries, he should direct others present how to assist him in caring for the patient. Do not attempt any unnecessary movement of the patient's body or limbs. See that the injured part is in a position as normal as possible, except in dislocations, which should be supported and dressed in the line of deformity. Determine whether breathing is normal, and look for hemorrhage, shock, open wounds, fractures, dislocations, burns, and other injuries. In examining an injured person do not remove his clothes in the usual way, as you may cause unnecessary suffering and make his injury worse. If the injury is to the arms, legs, or body, cut the clothing from the body, preferably ripping the seams.

Unless absolutely necessary, do not move the person until you have a clear idea of what the injury is and have rendered first aid. If you believe that the injury is serious, that the patient is in a place safe from further injury, and that medical aid can be obtained promptly it is sometimes best not to attempt to move the patient but to render such emergency care as possible until the doctor arrives. This applies particularly to cases where adequate first-aid materials are not at hand for properly immobilizing major fractures.

Be calm and quiet. Keep onlookers from crowding around the patient and preventing free access of air for breathing. Do not wait for a doctor, as delay often is dangerous. Endeavor to make the patient comfortable by doing whatever is necessary, but no more. Loosen tight clothing, especially about the neck,

chest, and waist. If the patient's face is flushed, put something under his head to raise it. If his face is pale, keep head on a level with his body. If he vomits, turn his head to one side so that the vomited matter will flow from the mouth and not get into his windpipe and choke him. Remove false teeth, tobacco, gum, or other foreign matter from his mouth, and see that his tongue is forward and not back over his windpipe. Never attempt to give an unconscious person water or any other liquid by mouth, as it may enter the windpipe and strangle him. If the patient is conscious, give him all the water he wants, but give it slowly and in sips.

Frequently it is dangerous to let an ill or injured person sit or stand, and to permit him to walk may cause his death. A seriously injured person always should be kept lying down and if pale or cold to the touch should be covered with blankets, brattice cloth, or clothing. Always place under the patient blankets, brattice cloth, or clothing to exclude cold from the ground. If at hand, heated objects should be wrapped and tested against your own skin and, if not too hot, should be placed next to the body of the injured person under the covering. Always cheer your patient and keep him hopeful.

If regular first-aid material is not at hand, make your own splints, tourniquets, or stretchers of material that may be found near the place of the accident. When several injuries are present, treat the most serious one first, especially if it involves severe loss of blood. Always remember that a first-aid man should not attempt work that should be done by a physician or surgeon.

OUTLINE OF BUREAU OF MINES STANDARD FIRST-AID COURSE

The Bureau of Mines has established an outline for its standard course in first aid. To assist uniformity and to provide identical training for employees of the mineral industries, instructors conducting classes must follow the outline if the

members of their classes are to be eligible for examination for Bureau of Mines certificates of first-aid training. Roll calls will be held at the beginning and at the close of each instruction period, and a complete record of attendance of each individual will be kept.

Instructor's Outline

STANDARD FIRST-AID COURSE

Section 1

1. Brief talk on purpose and benefits of first-aid training.
2. Brief talk on anatomy of human body. (Use charts.)
   (*a*) Skeleton.
   (*b*) Joints.
   (*c*) Muscles and tendons.
   (*d*) Skin.
   (*e*) Chest cavity and contents.
   (*f*) Abdominal cavity and contents.
   (*g*) Excretory systems.
3. Artificial respiration.
   (*a*) Air passages, chest, diaphragm, and lungs in respiration.
   (*b*) The needs for artificial respiration.
      (1) Electric shock.
      (2) Gas poisoning.
      (3) Drowning.
      (4) Other asphyxiations.
   (*c*) Describe and demonstrate preparation of patient for artificial respiration, including rescue from dangerous places.
   (*d*) Describe and demonstrate the Schaefer and the Sylvester methods of artificial respiration.
   (*e*) Describe and demonstrate change of operators without breaking rhythm.

(*f*) Class practice with both the Schaefer and Sylvester methods of artificial respiration and change of operators until each member is proficient.

(Statistics show that more lives are saved by artificial respiration than by any other first-aid procedure. The importance of having class members trained in giving artificial respiration demands that each member of the class demonstrate personal knowledge of the preparation of the patient, and in the Schaefer method the proper position of the body and hands of the operator before the expiration stroke, at the completion of the expiration stroke, and the proper rhythm.)

NOTE.—The work of the instructor will be greatly facilitated by mentioning practical or actual cases when talking to the class on the value of first aid; for example, give instances where life has been saved by artificial respiration, control of bleeding, or similar treatment.

Section 2

1. If previous section has not been completed, finish it.
2. Complete review of previous section, with special emphasis on *artificial respiration.*
3. Pass out triangular bandages.
   (*a*) Demonstrate folding triangular bandages.
      (1) Open triangular bandage.
      (2) Wide cravat bandage.
      (3) Medium cravat bandage.
      (4) Narrow cravat bandage.
   (*b*) Class practice folding cravat bandages.
   (*c*) Demonstrate tying square knot.
   (*d*) Class practice tying square knot.
4. Control of bleeding.
   (*a*) Explain the heart and its action. (Use chart.)
   (*b*) Explain the circulatory system—blood, heart, arteries, veins, and capillaries—and purification of blood through lungs.
   (c) Amount of blood in the body and time it takes a person to bleed to death.

(*d*) Describe symptoms of arterial, venous, and capillary bleeding.
(*e*) Describe methods of controlling bleeding.
(1) Digital pressure.
(2) Tourniquet.
(3) Direct pressure.
(4) Elevation.
(5) Cold applications.
(*f*) Point out pressure points of arterial system and demonstrate control of arterial bleeding by digital pressure. (Use chart.)
(*g*) Explain to class tourniquet and improvised tourniquet, when and how to use them, and danger of not loosening at 10-minute intervals.
(*h*) Demonstrate application of tourniquet to pressure points.
(*i*) Have class apply digital pressure to all pressure points.
(*j*) Have class apply tourniquet to pressure points on arm, elbow, wrist, thigh, and knee.

5. Shock.
(*a*) Describe the nervous system.
(*b*) Describe physical shock.
(1) Causes.
(2) Effects—complete symptoms.
(*c*) Types of shock.
(1) Red—symptoms.
(2) White—symptoms.
(3) Blue—symptoms.
(*d*) Treatment of shock. (Differentiate the treatment for shock according to symptoms presented.)
6. Fainting.
7. Heat exhaustion.
(*a*) Describe symptoms.
(*b*) Give treatment.

8. Heat cramps.
   (*a*) Describe symptoms.
   (*b*) Give treatment.
   (*c*) Prevention.
9. Sunstroke.
   (*a*) Describe symptoms.
   (*b*) Give treatment.
10. Apoplexy.
   (*a*) Describe symptoms.
   (*b*) Give treatment.

Section 3

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with special emphasis on *artificial respiration*, *control of bleeding*, and *shock*.
3. Pass out triangular bandages and bandage compresses.
   (*a*) Have class practice folding cravat bandages.
   (*b*) Have class practice tying square knot.
   (*c*) Demonstrate use of bandage compress.
   (*d*) Have class practice application of bandage compress without contamination.
   (*e*) Demonstrate use of sterile gauze.
   (*f*) Demonstrate triangular bandage sling and cravat bandage sling.
   (*g*) Have class practice application of triangular bandage sling and cravat bandage sling.
4. Open wounds.
   (*a*) Describe the function of the skin in preventing infection.
   (*b*) Describe open wounds.
      (1) Abraded.
      (2) Incised.
      (3) Lacerated.
      (4) Punctured.
   (*c*) Describe treatment of open wounds, danger of infection, and method of guarding against infection.

5 Demonstrate and have class practice dressings for the following wounds:

(*a*) Extensive wound of scalp.
(*b*) Wound of scalp, face, temple, or ear.
(*c*) Wound of forehead or back of head.
(*d*) Injuries to eye.
(*e*) Wound of nose.
(*f*) Wound of chin.
(*g*) Wound of neck.
(*h*) Wound of shoulder.
(*i*) Wound of armpit.
(*j*) Arm torn from body.
(*k*) Amputation of arm or forearm.
(*l*) Wound of arm.
(*m*) Wound of elbow.
(*n*) Wound of forearm.
(*o*) Wound of wrist.
(*p*) Wound of palm of hand.
(*q*) Wound of back of hand.
(*r*) Extensive wound of hand or mashed hand.
(*s*) Wound of finger.
(*t*) Wound of end of finger.

NOTE.—Where bandages are similar in application—as arm, forearm, and wrist; palm of hand and back of hand; and thigh and leg—they may be demonstrated together; members of the class may then be divided into groups and each group may apply one type of dressing.

Section 4

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with special emphasis on *artificial respiration, control of bleeding, shock,* and *open wounds.*
3. Pass out triangular bandages, bandage compresses, and picric-acid gauze.

4. Demonstrate and have class practice dressings for the following wounds:
   (*a*) Wound between shoulders on back or chest.
   (*b*) Wound of back, chest, side, or abdomen.
   (*c*) Wound of lower part of abdomen, back, or buttocks.
   (*d*) Wound of groin.
   (*e*) Wound of crotch.
   (*f*) Wound of hip.
   (*g*) Wound of thigh.
   (*h*) Amputated thigh or leg.
   (*i*) Wound of knee.
   (*j*) Wound of leg.
   (*k*) Bleeding of varicose veins of leg.
   (*l*) Wound of ankle or foot.
   (*m*) Extensive wound of foot.
   (*n*) Wound of toe.
   (*o*) Wound of end of toe.
5. Burns and scalds.
   (*a*) Describe burns and scalds by degrees.
      (1) Causes:
         Dry heat.
         Moist heat.
         Chemicals.
      (2) Danger of infection.
      (3) Treatment:
         Burns or scalds by dry or moist heat.
         Burns by chemicals.
         Burns of eye by chemicals.
      (4) Demonstrate use of picric-acid gauze.
      (5) Describe use of tannic acid and the water-soluble burn ointments.
6. Demonstrate and have class practice dressings for the following:
   (*a*) Burn or scald of face, head, and neck.
   (*b*) Burn or scald of shoulder.

(*c*) Burn or scald of arm.
(*d*) Burn or scald of forearm.
(*e*) Burn or scald of hand.
(*f*) Burn or scald of back and shoulders.
(*g*) Burn or scald of chest and shoulders.
(*h*) Burn or scald of lower abdomen, lower back, or buttocks.
(*i*) Burn or scald of hip.
(*j*) Burn or scald of thigh.
(*k*) Burn or scald of leg.
(*l*) Burn or scald of foot.
(*m*) Composite burns of head, face, neck, body, and upper and lower extremities.

Section 5

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with special emphasis on *artificial respiration*, *control of bleeding*, *shock*, *open wounds*, and *burns*.
3. Pass out triangular bandages.
4. Closed wounds. Describe symptoms and treatment of—
   (*a*) Bruises.
   (*b*) Strains.
   (*c*) Sprains.
   (*d*) Demonstrate and have class practice dressing for sprained ankle.
   (*e*) Hernia.
   (*f*) Demonstrate and have class practice treatment for hernia.
   (*g*) Demonstrate proper method of lifting to prevent strains of back and hernia.
5. Describe and explain treatment of—
   (*a*) Foreign body in eye.
   (*b*) Foreign body in ear.
   (*c*) Foreign body in nose.

(*d*) Foreign body in throat or windpipe.
(*e*) Foreign body in stomach.

6. Dislocations.
   (*a*) Describe joints and give examples.
   (*b*) Describe symptoms and treatment of dislocations in general.
   (*c*) Name dislocations that may be reduced in first aid.
   (*d*) Describe danger in attempting to reduce other dislocations.
   (*e*) Describe and explain symptoms and treatment for dislocations of lower jaw, fingers, and toes.
   (*f*) Have class practice reduction of dislocations of lower jaw, fingers, and toes.
   (*g*) Describe symptoms, demonstrate, and have class practice dressings for the following dislocations:
      (1) Lower jaw.
      (2) Shoulder.
      (3) Elbow.
      (4) Wrist.
      (5) Hip.
      (6) Knee or kneecap.
      (7) Ankle.

Section 6

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with emphasis on *artificial respiration, control of bleeding, shock, open wounds, burns,* and *dislocations.*
3. Pass out triangular bandages and bandage compresses.
4. Fractures.
   (*a*) Describe types of fractures and characteristics of each type.
      (1) Simple fracture.
      (2) Compound fracture.

(*b*) Explain danger of converting simple fracture into a compound fracture.
(*c*) Explain danger of moving injured person before fracture has been splinted.
(*d*) Describe general symptoms of fractures.
(*e*) Give general directions for care of fractures.
  (1) Where fixed traction is not applied.
  (2) Use of tourniquet in compound fractures.
  (3) Padding splints.
  (4) Placing bandages for applying splints.
(*f*) Describe, demonstrate, and have class practice dressings for:
  (1) Fracture of skull:
    Symptoms.
    Dressing.
  (2) Fracture of nose:
    Symptoms.
    Dressing.
  (3) Fracture of upper jaw or cheekbone:
    Symptoms.
    Dressing.
  (4) Fracture of lower jaw:
    Symptoms.
    Dressing.
  (5) Fracture of collar bone:
    Symptoms.
    Dressing.
  (6) Fracture of shoulder blade:
    Symptoms.
    Dressing.
  (7) Fracture of uppper third of arm:
    Symptoms.
    Dressing.

(8) Fracture of lower two-thirds of arm, elbow, forearm, or wrist:
Symptoms.
Dressing.
(9) Fracture or crushing of bones of hand or fingers:
Dressing.
(10) Fracture of finger:
Dressing.

NOTE.—Part of the treatment for fractures demonstrated and practiced by the class should be for compound fractures, including dressing of wounds, application of tourniquet, and proper padding of splints to prevent pressure over ends of bones and wounds, and binding of the tourniquet.

Section 7

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with emphasis on *artificial respiration, control of bleeding, shock, open wounds, burns, dislocations,* and *fractures.*
3. Pass out triangular bandages and bandage compresses.
4. Fractures—Continued.
   (*a*) Describe, demonstrate, and have class practice dressings:
   (1) Fracture of rib:
   Symptoms.
   Dressing.
   (2) Fracture of spine:
   Symptoms.
   Describe method of determining:
   Fracture in region of the neck.
   Fracture below neck region.
   (3) Fractured or broken neck:
   Precautions in handling.
   Dressing.
   (4) Fractured or broken back:
   Precautions in handling.
   Dressing.

(5) Fracture of pelvis or hip:
Symptoms.
Precautions in handling.
Dressing.
(6) Fractures of lower extremity (thigh, knee, knee-cap, leg, and ankle):
General symptoms.
Dressing.
(7) Fracture or crushing of bones of foot or toes:
Dressing.

NOTE.—Part of the treatment for fractures demonstrated and practiced by the class should be for compound fractures, including dressing of wound, application of tourniquet, and proper padding of splints to prevent pressure over the ends of bones and wounds, and binding of the tourniquet.

Supplementary Section

The contents of this section will be included in the standard first-aid course where request is made for instruction covering fixed traction in applying splints for fractures of the long bones of the extremities.

1. Fixed traction in applying splints for fractures of the long bones of the extremities.

(*a*) Purpose.
(*b*) Advantages.
(*c*) General directions for handling.
(*d*) Fractures of long bones of upper extremity.
(1) Dressing with Thomas-type splint.
(2) Dressing with wood splint.
(*e*) Fractures of long bones of lower extremity.
(1) Dressing with Thomas-type splint.
(2) Dressing with wood splint.

Section 8

1. If previous section has not been completed, finish it.
2. Complete review of previous sections, with emphasis on *artificial respiration, control of bleeding, shock, open wounds, burns, dislocations*, and *fractures*.
3. Poisons.
   - (*a*) Prevention of poisoning.
   - (*b*) Means by which poisons gain access to body.
   - (*c*) Poisoning by mouth.
     - (1) Corrosive poisons:
       - Acids.
       - Alkalies:
         - Symptoms.
         - Treatment.
       - Carbolic acid and lysol:
         - Symptoms.
         - Treatment.
     - (2) Irritant poisons:
       - Symptoms.
       - Treatment.
     - (3) Systemic poisons:
       - Symptoms.
       - Treatment.
     - (4) Food poisoning:
       - Symptoms.
       - Treatment.
     - (5) Mushroom poisoning:
       - Symptoms.
       - Treatment.
   - (*d*) Poisons breathed in with air.
     - (1) Prevention.
     - (2) Early medical care.

(*e*) Poisons injected within skin.
  (1) Bites of rabid animals:
    Animal to be held for observation.
    First-aid care.
  (2) Bites of poisonous snakes:
    Symptoms.
    Treatment.
  (3) Bites and stings of insects—
    Causing local irritation:
      Symptoms.
      Treatment.
    Causing general symptoms:
      Symptoms.
      Treatment.
(*f*) Poisoning by contact with skin.
  (1) Systemic poisoning.
  (2) Dermatoses:
    Prevention.
    Medical care.
  (3) Poisoning by plants:
    Symptoms.
    Treatment.
  (4) Athlete's foot:
    Cause.
    Symptoms.
    Prevention.
    Treatment.

4. Frostbite.
  (*a*) Cause.
  (*b*) Degrees.
  (*c*) Treatment.
5. Freezing.
  (*a*) Symptoms.
  (*b*) Treatment.
6. Epilepsy.
  (*a*) Symptoms.
  (*b*) Care.

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7. Transportation.
   (*a*) Precautions in moving an injured person.
   (*b*) Demonstrate and have class practice:
      (1) One-man carry.
      (2) Two-man carry.
      (3) Three-man lift and carry.
8. Stretcher transportation.
   (*a*) Testing stretcher.
   (*b*) Precautions in movement.
   (*c*) Stretcher drill.
      (1) Fall in.
      (2) Count off.
      (3) Procure stretcher.
      (4) To patient.
      (5) Test stretcher.
      (6) Lift patient.
      (7) Place stretcher under patient.
      (8) Lower patient on stretcher.
      (9) Lift stretcher.
      (10) Carry stretcher.
      (11) Lower stretcher.
      (12) Load ambulance.
      (13) Carry stretcher over obstacle.
9. Where additional time is provided, team training is advisable.
   (*a*) Divide class into teams.
   (*b*) Train teams to work problems and perform teamwork.
10. Examination of class by class instructor.
   (*a*) Oral examination.
   (*b*) Practical examination.

NOTE.—This outline is to be followed by Bureau of Mines instructors and all cooperative first-aid training instructors. The sections as outlined are suggestions as to the scope of each lesson and are based on 2 to 2½ hours of actual working time. Local conditions may change the length of time that may be given to each instruction period. Where periods have to be shortened as to time they must be increased in

number to cover at least a full 15 hours and the entire subject matter of the course completed. The sequence of the outline as to subjects and material must be followed strictly. All subjects must be studied in the order given in the outline, reviews held as indicated, and roll call held at the beginning and ending of each period of instruction. Bureau of Mines representatives will not examine cooperatively trained classes until the complete course of instruction has been given.

ANATOMY OF THE HUMAN BODY

To understand the reasons for many first-aid procedures and to render intelligent and efficient first aid, it is necessary for those taking first-aid training to know something about the anatomy (structure) and physiology (work) of the human body and its more important organs. The body is composed of solids (bones and tissues) and fluids (blood and secretions of various organs and membranes).

The human body is divided into three parts:

1. The head, made up of the skull (a bony case that encloses and protects the brain) and the face (including the eyes, ears, nose, and mouth).

2. The trunk, the main part of the body, is divided into two parts by a muscular partition known as the diaphragm. The upper portion of the trunk is the chest, its cavity, and organs. The lower portion is the abdomen, its cavity, and organs.

3. The extremities: The upper extremity on each side consists of the shoulder joint, the arm, the forearm, the wrist, and the hand. The lower extremity on each side consists of the hip joint, the thigh, the leg, the ankle, and the foot.

THE SKELETON

The adult human skeleton (fig. 4) is composed of approximately 200 bones which are classified according to shape as long bones, short bones, flat bones, and irregular bones. The skeleton forms a strong but flexible framework for the body, supports and

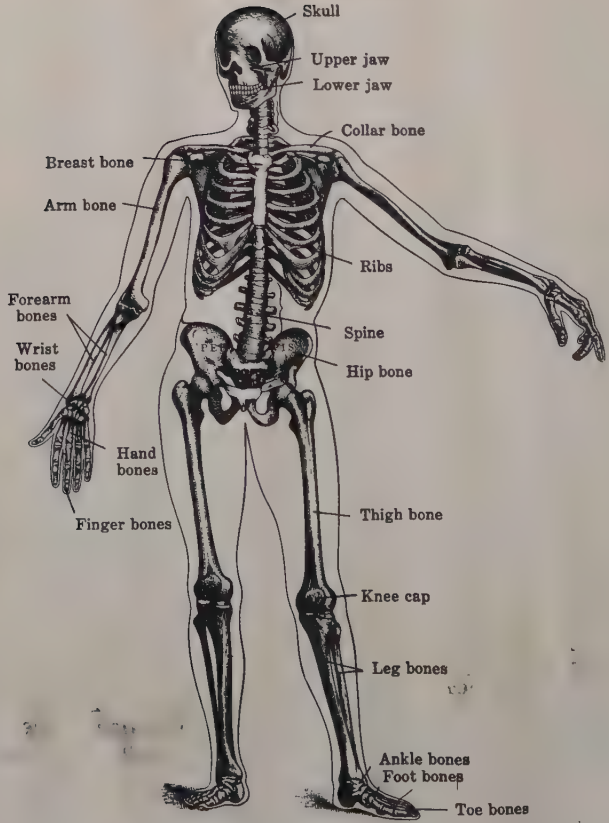

FIGURE 4.—The skeleton.

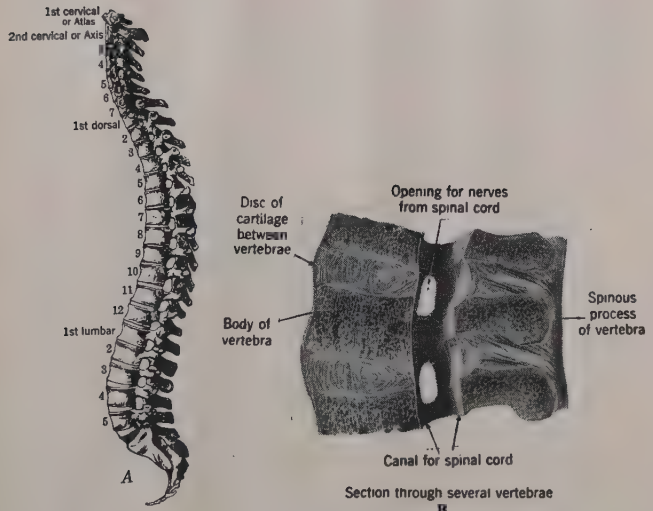

FIGURE 5.—The spinal column and section through several vertebrae.

carries the soft parts, protects vital organs from injury, gives attachment to muscles and tendons, and forms joints so that movements are possible.

Head.—The head is composed of 22 bones, 8 of which are closely united to form a bony case—the skull—which encloses the brain; 14 other bones enter into the formation of the face. The only movable bone in the head is the lower jaw.

Trunk.—The trunk is composed of 54 bones. The spinal column or backbone (fig. 5) in the adult consists of 26 segments called vertebrae joined by strong ligaments to form a flexible column that encloses the spinal cord. The chest is formed by 24 ribs, 12 on each side, which are attached in the back to vertebrae or segments of the spinal column. The 7 upper ribs are attached in front to the breastbone by means of cartilage. The next 3

FIGURE 6.—The pelvic basin.

ribs are attached in the front by a common cartilage to the seventh or rib above instead of to the breastbone. The lower 2 ribs, known as the floating ribs, have no attachment in front. The pelvis or basin-shaped bony structure at the lower portion of the trunk is made up of the two lower segments of the spinal column or backbone, the sacrum and coccyx, and the wing-shaped hip bones on either side, which are joined in front by strong, fibrous ligaments (fig. 6).

Extremities.—Each upper extremity consists of 32 bones—the collarbone, the shoulder blade, the arm bone, the 2 bones of the forearm, the 8 bones of the wrist, the 5 bones of the hand, and the 14 bones of the fingers. Each lower extremity consists of 30 bones—the thigh bone, the kneecap, the 2 bones of the leg, the 7 bones of the ankle, the 5 bones of the foot, and the 14 bones of the toes.

The important bones to keep in mind in first aid are:

The bony case or skull enclosing the brain.
The lower jawbone.
The collarbone.
The shoulder blade.
The bone of the upper arm.
The two bones of the forearm.
The bones of the wrist.
The bones of the hand.
The bones of the fingers.
The rib bones.
The spinal column or backbone made up of its many segments.
The bones of the pelvis, particularly the wing or hip bones.
The bone of the thigh.
The kneecap.
The two bones of the leg.
The bones of the ankle.
The bones of the foot.
The bones of the toes.

JOINTS

Where two or more bones come together they form a joint. The ends of bones forming a joint are covered by cartilage; in a free-moving joint there is a membrane between the cartilage covering the ends of the bones that secretes a fluid to keep the joint lubricated. The bones forming a joint are held in place

FIGURE 7.—The surface muscles of the body.

by strong ligaments and bands of fibrous tissue. A sac or capsule encloses a free-moving joint. Joints are immovable, limited in motion, or freely movable.

MUSCLES AND TENDONS

Muscle tissue or flesh forms a covering for the skeleton and gives the body its shape and contour. (See fig. 7.) The fibers forming the muscles are bound together in bundles of different length, breadth, and thickness. Bundles of muscle fibers can shorten, lengthen, and thicken, by which means movement of the various parts of the body is made possible.

Tendons are strong, fibrous cords that attach muscles to bones. The tendons are inelastic, but the power of contraction or extension of the muscles to which they are joined causes the bones forming joints to move either by flexing or extending.

THE SKIN

The skin is the protective covering of the body, and in it are the special organs for the sense of touch. It also performs the function of getting rid of body heat and of some of the impurities of the body through its sweat glands. It consists of two layers, an external layer (the epidermis) and a deeper layer or true skin (the dermis). The skin is continuous with the mucous membrane that lines openings leading to or from the interior of the body.

THE CHEST CAVITY AND ITS CONTENTS

The chest cavity (fig. 8) is formed by the upper part of the spinal column or backbone, at the back; the upper 8 ribs and chest muscles, on the sides; the ribs, chest muscles, and breast bone, in front; the first rib and neck muscles, at the top; and the

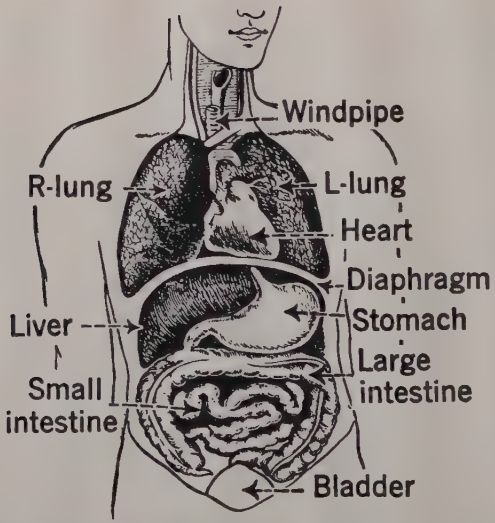

FIGURE 8.—The chest and abdominal cavities and their contents.

strong, muscular partition—the diaphragm—at the bottom. The diaphragm is dome-shaped, reaching a lower level in the back than in the front. The chest cavity is cone-shaped, narrow at the top and broad at the base, and is lined with a serous membrane known as the pleura.

Most of the chest cavity is occupied by the lungs, right and left. Near the center, in the front but extending more to the left of the median line and with its base resting on the dia-

phragm, is the heart. Besides the lungs and heart, the chest cavity contains the esophagus or food pipe, the trachea or windpipe, and several large blood vessels.

THE ABDOMINAL CAVITY AND ITS CONTENTS

The abdominal cavity (fig. 8) is formed by the lower portion of the spinal column or backbone and the back muscles in the back; the lower four ribs and abdominal muscles, on the sides; the abdominal muscles, in front; the diaphragm, on top; and the pelvic basin, below.

The abdominal cavity contains the liver, the stomach, the spleen, the pancreas, the small intestines, the large intestines, the kidneys, the bladder, other organs, and large blood vessels. At the upper right is the liver, while the stomach is at the upper left. The bladder is in the center, in the lower portion of the abdominal cavity.

EXCRETORY SYSTEMS

The waste products that enter or are formed within the body are eliminated by several different systems. The residue of food that is taken into the digestive system, mainly indigestible materials, together with the secretions from various glands emptying into the intestines, are gathered in the lower portion of the large intestines—the rectum—and eliminated as feces.

Excess water carrying dissolved salts that are either in excess in the system or formed as waste products is secreted by the kidneys, collected in the bladder, and expelled as urine.

Carbon dioxide and certain volatile products carried by the blood are exchanged in the lungs for oxygen and pass from the body in exhaled air.

In the skin are many small organs known as sweat glands. They range in number from 400 to 2,800 per square inch, accord-

ing to location, over the body surface. These glands play an important part in eliminating body heat and excess fluid and dissolved waste products from the body.

Life and health depend on the body throwing off its waste products; interference with or lessening of normal functioning of any of the excretory systems results in illness and may even cause death.

FIRST-AID DRESSINGS

First-aid dressings consist of triangular bandages, either open or cravat bandages, sterile bandage compresses, sterile gauze, picric-acid gauze, tourniquets, and splints.

BANDAGES

A bandage is used to cover wound and burn dressings, to make improvised tourniquets, to support dislocations, to apply splints, and to form slings. If a regular-size bandage is found to be too short when a dressing is applied, it can be lengthened by tying a piece of another bandage to one end.

TRIANGULAR BANDAGES

The triangular bandage (fig. 9) is recommended by the Bureau of Mines because it is easily applied and can be handled by the first-aid man in such a way that the part applied over wound or burn dressings will not be soiled, and it does not tend to slip off when once applied correctly. It is usually made from unbleached cotton cloth, although any kind of cloth will answer the purpose. In emergencies a triangular bandage can be improvised from a clean handkerchief, a clean piece of shirt, or a clean napkin. The standard triangular bandage is made from a piece of cloth 40 inches square by folding the square diagonally and cutting along the fold.

FIGURE 9.—Method of folding cravat bandages: *A*, Hem folded along base; *B*, apex placed under the hem, wide cravat bandage; *C*, medium cravat bandage; *D*, narrow cravat bandage.

CRAVAT BANDAGES

The triangular bandage may be used in two forms, open and folded, as in figure 9; when folded it is known as a cravat. To form a cravat bandage make a 1½-inch fold along the base of the triangular bandage, then bring the apex to the center of the base, placing the apex underneath the fold. This makes a wide cravat bandage. This bandage may be divided again by folding lengthwise along a line midway between the base and the new top of the bandage. This makes a medium cravat bandage. The operation of folding is repeated, and a narrow cravat bandage is formed.

This method has the advantage that all bandages can be folded to uniform width or varied as to width to suit the purpose for which used. To complete a dressing, the ends of the bandage are tied together securely. Knots should be placed where they do not cause discomfort and where they may be reached easily. The reef or square knot is recommended.

REEF OR SQUARE KNOT

A reef or square knot is a double knot in which the free ends of the second tie lie in the same plane as the ends of the first tie. In making a reef or square knot tie a single knot. Take the ends and turn them until they lie parallel to the bandage. Take one end and turn it back across the knot on the same side of the bandage. Take the other end, cross the first end, and complete the knot, as shown in figure 10. Unless otherwise specified, all knots or ties mentioned in this manual should be reef or square knots.

BANDAGE COMPRESS

A bandage compress (fig. 11) is a special dressing to cover open wounds. It consists of a pad made of several thicknesses of sterile gauze sewed to the middle of a strip of muslin. Three

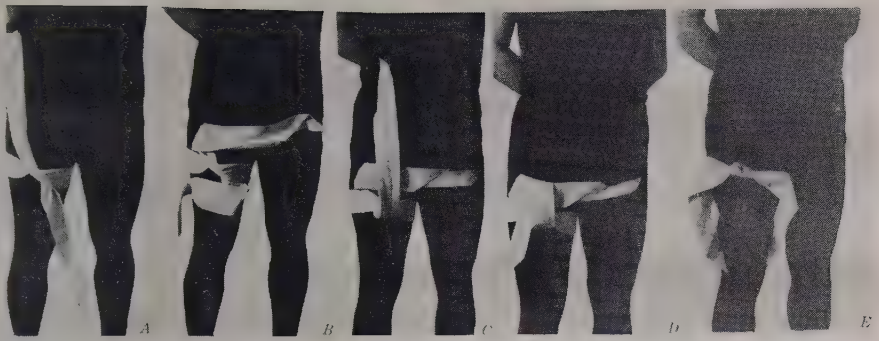

FIGURE 10.—Method of tying reef or square knot: *A*, Single knot tied; *B*, ends laid parallel to bandage; *C*, one end crossed over the other; *D*, end passed through loop; *E*, knot completed.

sizes are used—small, medium, and large. Bandage compresses come folded so that the sterile gauze pad can be applied directly to the open wound with virtually no exposure to the air or fingers. The strip of muslin at either side of the sterile gauze pad is folded back, can be opened up, and the bandage compress tied in place with no disturbance of the sterile pad application. The gauze of a bandage compress may be extended to twice its normal size by ripping the stitching on one side and opening up the folded gauze. Unless otherwise specified, all bandage compresses and all gauze dressings must be covered with open triangular or cravat bandages.

GAUZE

Two kinds of gauze—sterile and picric acid—are used at various times in applying first-aid dressings; sterile gauze may be used in place of a bandage compress to cover large wounds. If sterile gauze is required and is not available, it may be procured by loosening the stitches on the back of a large bandage compress, tearing off the gauze, and fluffing it after removal from the muslin strip of the bandage compress. Care should be taken not to touch the portion of the gauze that is to be placed directly in contact with the wound. Picric-acid gauze is gauze that has been treated with a solution of picric acid. It is used for dressing burns. For other types of dressing for burns see Burns, page 134. Both sterile gauze and picric-acid gauze usually are obtained in packets containing 1 square yard of gauze, folded.

SPLINTS

Splints are used to support and protect injured parts, such as dislocations, broken bones, or suspected broken bones, and to prevent movement at the point of fracture and at the nearest joint. They must be of stiff material. Improvised splints may be made from pieces of wood, broom, pick, or shovel handles,

FIGURE 11.—Bandage compress: *A*, Folded; *B*, open.

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mine augers, drills, rules, laths, heavy cardboard, canes, umbrellas, sprags, cap boards, newspapers, magazines, or other similar material. (See description of Thomas-type splints under Fractures, pp. 198 and 201.)

In making a splint for a fracture always remember that, besides being firm and stiff, it should be long enough to prevent movement at the joints on both sides of the fracture and that, if possible, it should be as wide as the thickness of the limb to which it is applied. Splints should be well padded with some soft material on the inner side and at the ends that come in contact with the body.

SLINGS

Slings are used to support injuries of the shoulder, arm, elbow, forearm, wrist, hand, or fingers. In an emergency they may be improvised from belts, ties, handkerchiefs, or similar material, but bandages should be used if available.

TRIANGULAR BANDAGE SLING

Place one end of the base of an open triangular bandage over the shoulder of the injured side, allowing the bandage to hang down in front of chest so that the apex will be behind the elbow of the injured arm (see fig. 12) ; bend the arm at the elbow, thus bringing the forearm across the chest over the bandage. Then carry the lower end of the bandage over the shoulder of the uninjured side and tie behind the neck. Tuck the apex of the bandage in at the elbow.

CRAVAT BANDAGE SLING

In making a cravat bandage sling place the center of a medium cravat bandage under the injured person's wrist and part of the hand, the inner end passing over the shoulder of the injured side and the other end passing over the shoulder of the uninjured side. (See fig. 12.) Tie at the back of the neck.

FIGURE 12.—Arm slings: *A*, Triangular bandage sling; *B*, cravat bandage sling.

A tourniquet is an appliance used to check severe bleeding from an artery. If a regularly constructed tourniquet is not at hand one can be improvised from a strap, belt, suspenders, handkerchief, towel, bandage, necktie, a piece of brattice cloth, rubber tubing, or other suitable materials. Never use wire, cord, or anything that will cut into the flesh. The application of tourniquets will be discussed in detail in connection with the control of bleeding.

RESPIRATION

Respiration is breathing by which air is taken into the lungs during inspiration and forced out of the lungs during expiration. In passing to and from the lungs the air passes through the nose, the throat, and the windpipe. In the nose the air is warmed and moistened. By means of the moist hairs and the moist mucous membrane of the nose, much of the dust in breathed air is filtered out. Moreover, the special sense of smell that warns of the presence of some harmful gases is situated in the nose.

The throat is a continuation of the nose and mouth; at its lower end are two openings, one in front of the other. The one in front is called the trachea or wind pipe and leads to the lungs. The one behind is called the gullet or foodpipe and leads to the stomach. (See fig. 13.)

At the top of the windpipe is a flap, the epiglottis, which closes over the windpipe during the act of swallowing to prevent food or liquid from entering it. When a person is insensible or unconscious the flap may fail to act; therefore, no solids or liquids should be given by mouth, as they may enter the windpipe and cause strangulation. The tongue of an uncon-

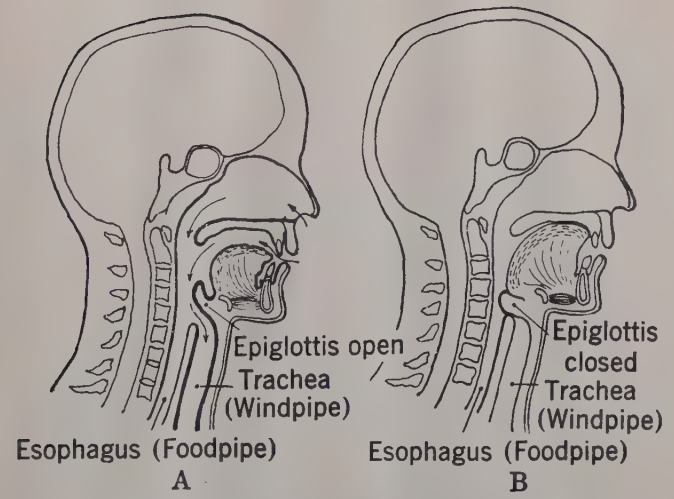

FIGURE 13.—Nose, throat, trachea, and gullet with: *A*, Epiglottis open; *B*, epiglottis closed.

scious person, especially if he is lying on his back, is apt to fall back on the epiglottis or flap over the windpipe and prevent air from reaching the lungs. Always see that the tongue is pulled forward when a person is unconscious or where breathing is embarrassed.

The windpipe extends into the chest cavity and divides into the right and left bronchi, one passing to the right and one to the left lung. Each bronchus enters the lung and divides and subdivides into many branches known as bronchial tubes.

LUNGS

The lungs (fig. 14) are two cone-shaped bodies that are soft, spongy, and elastic. The outside of each lung is covered by a closed sac called the pleura. The inner part of the lungs communicates freely with the outside air through the windpipe. The outside of the lungs is protected from air pressure by the walls of the chest cavity, creating a lessened pressure within the enveloping lung sac. The air pressure within the lungs expands them until they fill almost the entire chest cavity.

If any air gets through the chest wall, or if the lung is punctured so that air from the outside can communicate with the pleural sac, the lungs shrink because the air pressure is equalized on the outside and inside of the chest cavity.

After subdividing into very small branches the bronchial tubes end in a group of air cells resembling a bunch of grapes, except that they are many times smaller. Around each air cell, which has very thin walls, is a fine network of small blood vessels or capillaries. The blood in these capillaries gives up the carbon dioxide and other waste matter brought from tissue activity all over the body, through the thin air-cell wall and in exchange takes on a supply of oxygen from the air breathed into the air cells. The discarded carbon dioxide and waste matter pass from the air cells in air breathed out of the lungs.

Breathing is an act over which we exert little control. It occurs in the healthy adult about 15 times a minute when at rest but the rate per minute may be increased by exercise, labor, and a number of other causes. The amount of air entering and leaving the lungs during each respiration varies, as does the rate of breathing, according to whether the person is at rest or engaged in work or exercise. At rest adults breathe 25 to 30 cubic inches of air per respiration, whereas during strenuous effort the amount may be increased several times that breathed when at rest.

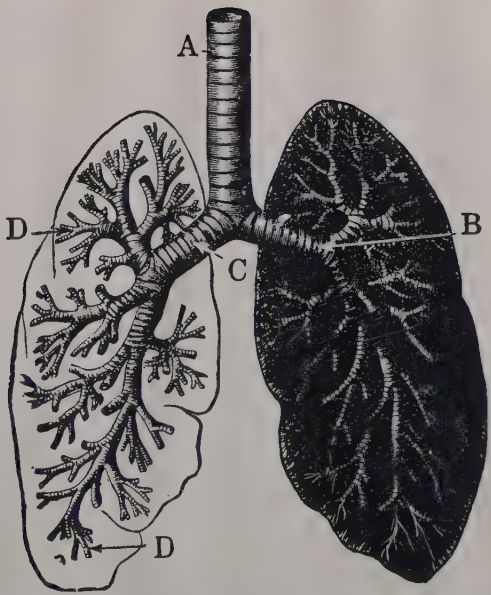

FIGURE 14.—The lungs: *A*, Trachea; *B* and *C*, bronchi; *D*, bronchial tubes.

Breathing consists of two separate acts, inspiration, an enlargement of the chest cavity with a lowering of the pressure within the cavity, during which air is drawn into the lungs, and expiration, a lessening of the chest cavity and increasing of the pressure within the cavity, during which air is driven out of the lungs. In inspiration, which is chiefly a muscular

act, the ribs are raised and the arch of the diaphragm falls and becomes flattened, thus increasing the capacity of the chest cavity, and tending to produce a vacuum causing air to enter. In expiration, an act performed with slight muscular action, the ribs fall to their normal position and the arch of the diaphragm rises, lessening the capacity of the chest cavity, and air is forced out.

As all living tissues of the body depend for life on the oxygen carried by the blood, interference with breathing that reduces fresh supplies of oxygen to the blood produces a condition of oxygen want or asphyxia throughout the entire body.

ARTIFICIAL RESPIRATION

Artificial respiration is a method by which normal respiration is imitated by manual movements to restore breathing. As we have no means of influencing muscular action in an unconscious person to produce normal inspiration, we have to depend on manual means of forcing air from the lungs by compression and on natural elasticity of the walls of the chest cavity plus the drop of the arch of the diaphragm to draw fresh air into the lungs when the compression is released.

Where breathing has stopped or is very irregular and feeble artificial respiration is usually required. The most frequent conditions under which artificial respiration is required are electric shock, gas poisoning, drowning, and suffocation from various causes. It has been estimated that 12,000 deaths occur each year from the above causes but that 40,000 to 50,000 lives are saved annually by application of artificial respiration, with the use of the oxygen inhaler, where available.

In many conditions where breathing has ceased or apparently ceased, the heart action continues for a limited time. If fresh air is brought into the lungs, so the blood can obtain the needed oxygen from the air, life can be sustained. That can be accomplished in a great number of cases by artificial respiration.

Every moment of delay is serious. As the breathing may be so faint that it will not be detected by the layman or first-aid man, it is advisable that artificial respiration be started immediately, even if the person seems dead. Continue artificial respiration without interruption until natural breathing is restored, or until a physician declares that the patient is dead. Persons have been resuscitated after as long as 72 hours of artificial respiration. If natural breathing stops after being restored, give artificial respiration again.

An assistant should remove from the patient's mouth all foreign bodies, such as false teeth, tobacco, gum, and any loose material, see that the tongue is forward and not over the windpipe, and loosen tight clothing from the victim's neck, chest, and waist. *Keep the patient warm by wrapping with blankets, clothing, or other suitable material.* Hot-water bottles, hot bricks, or other heated objects, well wrapped in cloth or paper and tested, should be placed about the victim. Place aromatic spirits of ammonia near the patient's nose, determining a safe distance by first trying how near it may be held to your nose. *Do not give any liquid by mouth until the patient is fully conscious,* when aromatic spirits of ammonia (1 teaspoon in one-half glass of water), hot coffee, hot tea, or hot water may be given *slowly.* Keep the patient lying down. If after being partly resuscitated he must be moved, carry him on a stretcher.

Perform artificial respiration gently and slowly. Roughness may injure the patient. Always treat the patient for shock in addition to the artificial respiration. Do not permit bystanders to crowd around. Assistants should not do anything that will interfere with the operator.

The Schaefer (prone-pressure) method and the Sylvester method of artificial respiration are both recommended. *The prone-pressure method being the simpler and easier to perform, it should be used in all cases where possible.* However, there may be a few instances where the Sylvester method can be employed more satisfactorily.

HOW TO GIVE ARTIFICIAL RESPIRATION BY THE PRONE-PRESSURE METHOD [2]

Lay the patient on his belly, one arm extended directly overhead, the other bent at the elbow, and turn the head toward the extended arm so the side of the face will rest on the hand or forearm of the bent arm, and the nose and mouth will be free for breathing. (See fig. 15, *A*.)

Kneel, straddling the patient's thighs with your knees placed such a distance from the hip bones as will allow you to place the palms of the hands on the small of the back with the fingers resting on the ribs, the little finger just touching the lowest floating rib, the thumb and fingers in a natural position, and the tips of the fingers just out of sight on the sides of the trunk. (See fig. 15, *B*.) If conditions make it impracticable for the operator to straddle both thighs, he may assume a position where but one thigh is straddled.

With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. (See fig. 15, *C*.) Do not bend the elbows. This operation should take about 2 seconds.

Now, swing backward immediately to remove the pressure completely.[3] After 2 seconds swing forward again. Thus, re-

[2] This method is essentially the same, except that wording and description have been changed to make it more understandable, as that approved by the following organizations: American Telephone & Telegraph Co., American Red Cross, American Gas Association, Bethlehem Steel Co., National Electric Light Association, National Safety Council, Bureau of Medicine and Surgery (Navy Department), Office of the Surgeon General (War Department), Bureau of Mines, National Bureau of Standards, U. S. Public Health Service, and various others.

[3] In actual work the hands may or may not be entirely removed from the patient. In contests, for uniformity, the operator will entirely remove the hands and assume the position shown in the top picture of figure 15 between each complete respiration and the next.

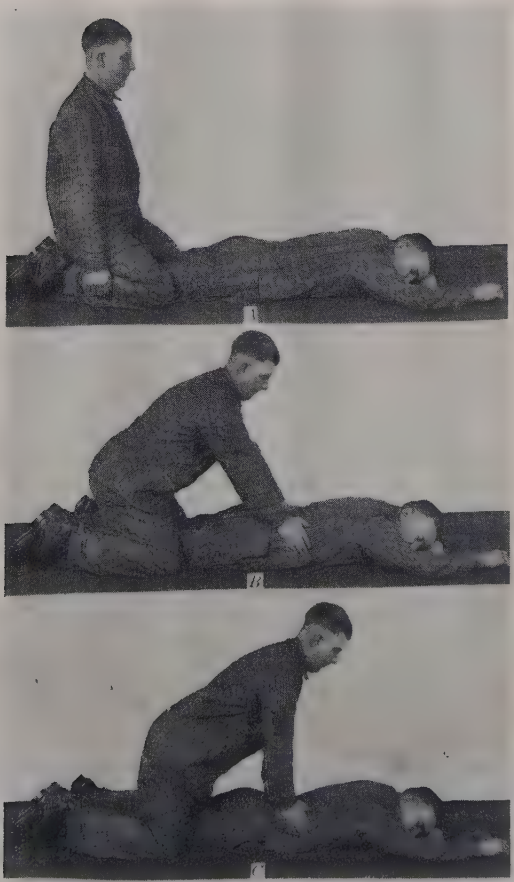

FIGURE 15.—Artificial respiration, prone-pressure method: *A*, Patient prone, operator in position; *B*, inspiration; *C*, expiration.

NOTE.—Arms are straight at end of expiration stroke to form vertical lines between shoulders and heel of hands.

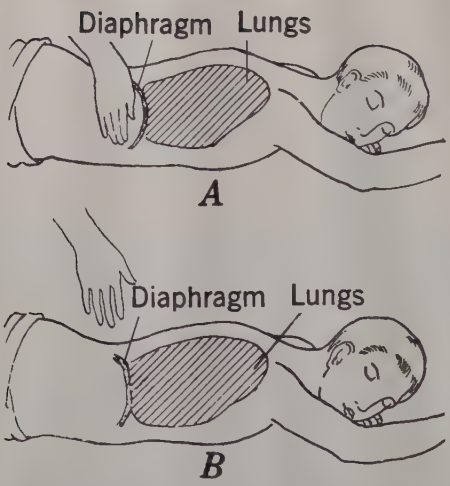

FIGURE 16.—The chest cavity and lungs in the prone-pressure method of artificial respiration: *A*, Compressed; *B*, expanded.

peat deliberately 15 times a minute the double movement of compression and release (fig. 16, *A* and *B*), a complete respiration in 4 seconds.

As soon as artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. Keep the patient warm. Do not give any liquids whatever by mouth until the patient is fully conscious.

To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or to sit up. If the doctor has not arrived by the time the patient has revived

and is conscious, he should be given some stimulant, such as 1 teaspoon of aromatic spirits of ammonia in half a glass of water or a hot drink of coffee or tea. The patient should be kept warm.

Resuscitation should be carried on in a safe place nearest possible to that where the patient received his injuries. He should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be necessary, due to extreme weather or other conditions, to move a patient before he is breathing normally, resuscitation should be continued while he is being moved.

A brief return of natural respiration is not a certain indication for stopping the resuscitation treatment. Not infrequently a patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched; if natural breathing stops, artificial respiration should be resumed at once.

CHANGE OF OPERATORS

In resuscitating a patient it often becomes necessary to change operators. There are many effective methods of making such changes. That adopted by the Bureau of Mines is as follows:

The relief operator kneels beside the patient and swings forward and backward in unison with the one giving artificial respiration. At a prearranged backward or decompression stroke the operator swings off the patient on the opposite side from the relief operator, and the relief operator swings into position straddling the patient's legs to make the next expiration or compression stroke. With a little practice this relief can be accomplished within the 2 seconds of decompression without confusion and the regular rhythm maintained.

HOW TO GIVE ARTIFICIAL RESPIRATION BY THE SYLVESTER METHOD

Place the patient on his back and remove from his mouth all foreign bodies, such as false teeth, tobacco, and gum. The

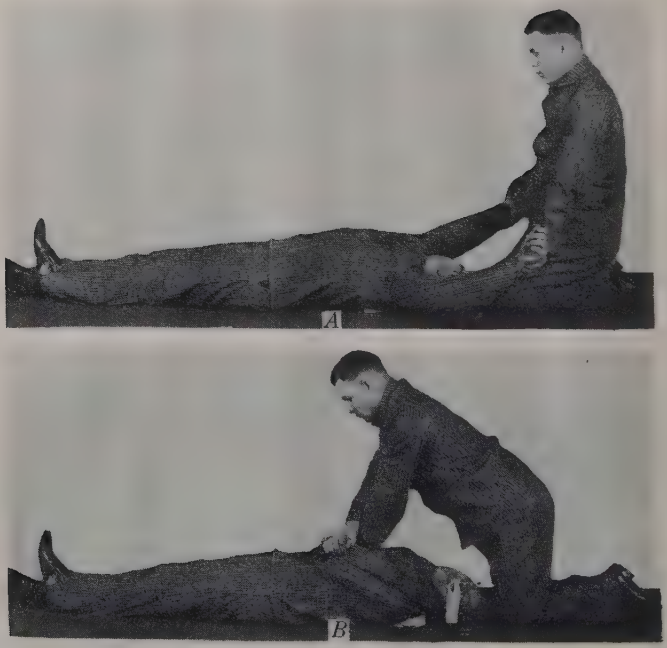

FIGURE 17.—Artificial respiration, Sylvester method: *A*, Inspiration; *B*, expiration.

tongue must be held out, as otherwise it will fall back and block the windpipe. Grasp it in a dry cloth or pincers. Have someone hold it out or, better, hold it out by a bandage or rubber band over the tongue and under the jaw. Place a rolled-up coat, a pad, or something else of the same shape and size under the patient's shoulders. This will straighten his windpipe. Kneel just above the patient's head; catch both his arms at the wrist. Draw the arms outward and upward gently and steadily, and hold them as far as they will go above the head. (See fig. 17, *A*.) This operation requires about 2 seconds, and the motion opens and expands the chest to the greatest possible extent. Certain muscles are attached to both arms and ribs, and when the arms are raised these muscles raise the ribs and so enlarge the chest. Then, bring the arms down until the elbows press against the chest, forearms crossed; with moderately increasing pressure diminish the size of the elastic chest. (See fig. 17, *B*.) This movement also requires about 2 seconds. Continue these motions 15 times per minute. When done properly this treatment is hard work for the operator, and he should be relieved by someone else as soon as he grows tired.

Even after natural breathing begins, watch carefully to see that it continues. If it stops, start artificial respiration again. Do not give any liquids whatever by mouth until the patient is fully conscious.

ADMINISTRATION OF OXYGEN

It is advisable to supplement artificial respiration by the administration of oxygen. This is especially important when the quantity of fresh air supplied to the patient by artificial respiration is small or insufficient, as is likely if the patient has been breathing poisonous gases. However, no time should be lost waiting for oxygen before artificial respiration is begun. When oxygen is given, the manual treatment should not be

stopped but should continue as long as there is hope of reviving the patient or until the patient starts to breathe normally. Oxygen frequently is available in compressed form in an oxygen bottle or cylinder. The valve should be opened slightly with the flow directed away from the patient. After a moderate flow has been established, the oxygen should be directed past the nose of the patient. Something, such as a cap, hat, or piece of cloth, to confine the oxygen to the face of the patient, or an oxygen inhaler, aids in its administration.

ELECTRIC SHOCK

Electricity causes shock by paralyzing the nerve centers that control breathing or by stopping the regular beat of the heart. Accidents from electricity are common in and around mines. Any electric current is likely to be dangerous.

The symptoms of electric shock are sudden loss of consciousness, absence of respiration (which, if present, is slight and cannot be detected), weak pulse, and probable burns. When necessary, rescue the person as quickly as possible, being careful not to get in contact with the live wire or other conductor. If a switch is near, turn off the current, but lose no time in looking for one.

Every second of delay in removing a person from contact with the electric current lessens the chance of resuscitating him. Act quickly but always in such a way that you are protected from contact. Stand on a dry board, thick, dry paper, or cloth; wrap one hand with a dry coat, cap, or other nonconducting material; and with the other hand behind your back drag the person from contact. If both hands must be used, see that both hands are insulated.

Another way is to take your belt, handkerchief, or coat, if they are dry, or a piece of dry rope and loop it over the victim's foot or head if he is lying on the wire and thus pull him off. If an ax is near at hand, use it to cut the wire, but first make

sure that the handle is dry, or wrap it with a coat or other dry nonconducting material. Or you may use a dry board, dry cloth, or dry rope to pull the wire away from the patient. In all cases the thing to do is to remove the wire from the man or the man from the wire, and, if the victim is not breathing, to start artificial respiration at once.

DANGEROUS GASES

The physiological effects of dangerous gases that may be found in the mining, metallurgical, petroleum, and allied industries are discussed below.[4]

METHANE

Methane (firedamp) has no effect on the human system; only when enough has entered the mine air to reduce the quantity of oxygen present does it interfere with breathing. When present, however, in certain proportions, it is highly explosive. Therefore, great care should be taken where there is an accumulation of methane, and no open lights or other means of ignition should be brought near it.

CARBON DIOXIDE

Carbon dioxide is a product of the decomposition of organic compounds and of the respiration of men and animals. It frequently is found in mines, tunnels, and wells in concentrations sufficient to cause headache, sweating, dim vision, trembling,

[4] For detailed information regarding the properties and physiological effects of dangerous gases see Bureau of Mines Miners' Circular 33, Mine Gases and Methods for Their Detection, by J. J. Forbes and G. W. Grove (1937, 82 pp.).

768735 O—48——6

unconsciousness, and even death. As little as 0.5 percent of carbon dioxide in the air will cause deeper and a little faster breathing, and 10 percent will cause serious symptoms. The breathing of black damp (a mixture of carbon dioxide and nitrogen) is dangerous. Black damp usually is recognized by its action on a flame safety lamp. Great care should be taken in entering old and unventilated workings, the bottom of sumps, and the reopening of old shafts, as black damp is very likely to be present in dangerous concentrations. When a person works in black damp he is affected not only by the black damp but also by the lack of oxygen in the atmosphere. In bad air the black damp often gives warning of the more serious danger, the lack of oxygen. A man working in bad air finds that his usual work is more tiring than when he works in pure air and that he is compelled to take frequent rests. A severe headache is made worse by stooping and is often accompanied by a sick stomach. In severe cases the power of the limbs is weakened, causing the victim to stagger. The face becomes flushed, and the flush deepens and becomes bluish. Often, in an atmosphere where only a small percentage of black damp is present and most of the oxygen has been replaced by nitrogen, the person may collapse into unconsciousness with virtually no warning. No man should be permitted to work where black damp is present.

SULFUR DIOXIDE

Sulfur dioxide in mines usually comes from the decomposition of sulfide minerals or from the burning of explosives that contain sulfur. It is very irritating to the eyes and respiratory passages, 1 part in 500 being almost intolerable to breathe; occasionally enough is present in the mine atmosphere to be dangerous. It is easily recognized by its characteristic odor and causes choking when breathed, as comes from burning sulfur.

OXIDES OF NITROGEN

Oxides of nitrogen are given off when nitroglycerin, blasting gelatin, dynamite, or other high explosives are burned rather than exploded. Peroxide of nitrogen is probably the most irritating of the oxides of nitrogen. The effects on the respiratory passages usually do not manifest themselves for several hours after exposure, when edema (swelling due to effusion of watery liquid into the connective tissue) takes place. This irritation may be followed by bronchitis or pneumonia.

AMMONIA

Ammonia is a colorless gas with a sharp, penetrating odor. It is irritating to all mucous membranes. Breathing low concentrations over long periods may cause chronic bronchitis. Breathing higher concentrations causes marked irritation, with violent sneezing; burning sensation in the throat; paroxysmal cough, with expectoration of thick, viscid mucus; difficult breathing; and inflammation of the respiratory organs that may result in death.

HYDROGEN SULFIDE

Hydrogen sulfide (stink damp) sometimes is found in mine air, but usually in small amounts. Some crude oils give off large amounts of this gas. In low concentrations it has a very repulsive odor that may serve as a warning; the fact that the sense of smell is lost after a few minutes' exposure (almost immediately in high concentrations) makes this gas extremely dangerous. Hydrogen sulfide is produced in mines in high-sulfide ores by some types of decomposition of such ores and under some conditions from the use of explosives in this ore; moreover, hydrogen sulfide sometimes accompanies water flows into mine workings. In some instances it has been attributed to the decomposition of organic debris. Hydrogen sulfide is very poison-

ous. Whenever it exists the possibility of poisoning is present. The exact low limit of concentration at which hydrogen sulfide ceases to act as a poison has not been determined, but it is evidently below 0.005 percent; 0.06 to 0.1 percent causes serious symptoms within a few minutes. In low concentrations hydrogen sulfide produces headache, sleeplessness, dullness, dizziness, and weariness. Pain in the eyes, followed by conjunctivitis, is fairly constant, while bronchitis and pains in the chest are frequent. Further poisoning produces depression, stupor, unconsciousness, and death. The heart continues to beat after respiration has ceased. In certain proportions hydrogen sulfide is highly explosive.

CARBON MONOXIDE

Carbon monoxide is produced by the burning of carbon-containing materials, such as coal, wood, gasoline, and explosives, whenever the supply of air is not adequate for complete combustion. Carbon monoxide is colorless, odorless, tasteless, and invisible. Although there may be only a very small percentage of carbon monoxide present in the air that is breathed the action of the gas is cumulative; that is, the carbon monoxide is gradually but continuously taken up by the blood and displaces the oxygen, causing the body to suffer from oxygen starvation. As little as 0.02 percent (2 parts in 10,000) of carbon monoxide in air will produce symptoms of poisoning in several hours, and 0.2 percent (20 parts in 10,000) may cause unconsciousness in 30 minutes. The first decided symptoms appear when about 30 percent of the blood is saturated with the gas. Death occurs when the saturation attains about 65 to 80 percent. This action of carbon monoxide explains the loss of many lives.

Another thing to be remembered is that if one is performing work in such an atmosphere his body will store more carbon monoxide than if he is at rest. In rescue work, men have proceeded a considerable distance in foul air before becoming affected and have not had enough oxygen-carrying elements in

the blood to bear them back to safety. Carbon monoxide poisoning steals upon the victim in such a way that he may be overcome by the gas before he is aware of its presence. Sometimes the poisoning takes effect suddenly. In mine disasters men have been found dead in their places with their picks in their hands as if working; others have been found in positions indicating that they were taking food when overcome.

The symptoms are numerous, the more pronounced being yawning, giddiness, ringing in the ears, weariness, and a fluttering or throbbing of the heart, which is a late symptom. If a person gets out of impure air into good air, these symptoms usually pass off, leaving perhaps a headache; if no attention is paid to the symptoms and the person continues working, he becomes more affected, feels his legs beginning to go from under him, and usually staggers until he sinks to the ground semiconscious or unconscious.

All cases may not begin in the same way. The symptoms may be so gradual that the body becomes full of the poison and the person falls unconscious before being aware of danger.

The aftereffects of carbon monoxide range from virtually none to headache, muscular pains, and paralysis. These usually clear up in a day or two, but in some instances they may extend over longer periods.

HYDROGEN CYANIDE GAS AND CYANOGEN GAS COMPOUNDS

Hydrogen cyanide gas and many of the cyanogen gas compounds are among the most poisonous gases known. They are used in many metallurgical processes. Death quickly follows inhalation of high concentrations of these gases. Like carbon monoxide they are cumulative, and exposure to low concentrations can build up a saturation of the hemoglobin of the blood that will endanger life. The symptoms of cyanogen poisoning are headache, vertigo, palpitation, shortness of breath, and prostration. In cyanogen poisoning medical assistance should be

procured immediately. The patient should be removed to fresh air and artificial respiration administered if he is not breathing; he should be treated for shock. In high concentrations, even where protective breathing equipment is worn, there may be enough absorption of the gas through the skin to cause poisoning and death.

PREVENTION OF GAS POISONING

The chief factors in preventing poisoning by the various toxic or noxious gases that may occur in mines or plants are:

Good ventilation, as this will dilute and carry away the gases.

Avoidance as much as possible of exposure to air known to contain poisonous gases.

Use of adequate protective equipment when atmospheres known to contain poisonous gases are to be entered.[6]

TREATMENT OF GAS POISONING

The steps in first-aid treatment of poisoning by toxic or noxious gases are:

Always remove the person to fresh air as quickly as possible.

Obtain medical aid.

If breathing has stopped, is weak and intermittent, or is present in but occasional gasps, start artificial respiration at once, and continue until normal breathing is resumed or until the heart has stopped. When giving artificial respiration, always administer oxygen if available.

Aid circulation by rubbing the limbs and keeping the body warm with blankets, hot-water bottles, hot bricks, or other heated objects, taking care that these do not burn the patient.

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[6] For protective equipment and atmospheres containing dangerous gases, see Bureau of Mines Circular 35, Protection Against Mine Gases, by J. J. Forbes and G. W. Grove (1937, 52 pp.).

Keep the patient at rest, lying down, to avoid any strain on the heart. Later he should be given plenty of time to rest and recuperate.

Inhalations of oxygen for 20 minutes, when given immediately, will greatly abate the severity of carbon monoxide poisoning, as well as decrease the possibility of serious aftereffects. Oxygen should be given whether the patient is conscious or unconscious.

All industries in which gas poisoning commonly exists should provide apparatus for the efficient administration of oxygen. Such apparatus should be placed at convenient points and employees trained in its use.

DROWNING

Always rescue the person as quickly as possible.

It is important after rescuing a drowning person to get the water out of his air passages and stomach. Place and lock your hands underneath the patient's stomach and lift him several times, thus bending his body and allowing the water to flow out of his mouth. Then lose no time in beginning artificial respiration. Usually life is extinct after a person has been submerged in water for 10 minutes. Nevertheless, victims have been revived after many hours of artificial respiration, so do not cease treatment too quickly.

SUFFOCATION OR ASPHYXIATION

Always rescue the person as quickly as possible. A victim of suffocation or asphyxiation becomes unconscious, his lips and ear lobes become blue, his pulse and breathing stop, and his pupils become dilated. The cause may be something blocking the windpipe and preventing the air from getting into the lungs, or inhalation of harmful gases. The rescuer should exercise due care to protect himself. Unless the air is good get the victim to pure air immediately, and start artificial respiration at once.

CIRCULATORY SYSTEM

The circulatory system (fig. 18) consists of the heart, the arteries, the veins, and the capillaries by which blood is carried to all parts of the body.

BLOOD SUPPLY

The blood consists of a fluid called serum or plasma and two types of cells, the red and the white. The function of the blood is to carry nourishment to all the tissues of the body, furnish heat and oxygen, and remove waste matter resulting from tissue activity to such organs of excretion as the lungs, the skin, the kidneys, and the bowels.

One-twelfth to one-fifteenth of the body weight is blood. A person weighing 150 pounds will have 10 to 12 pints of blood in his body. If the blood supply is cut off from tissues, they will die from lack of nourishment and oxygen.

HEART

The heart is a hollow, muscular organ about the size of a fist, in the lower left section of the chest cavity. By its pump action the blood is kept in constant circulation throughout the body. In a healthy person, with the body at rest, the heart contracts at the rate of about 72 times a minute. The effect of these contractions can be noted by the pulse, most easily felt on the thumb side of the inner surface of the wrist.

BLOOD VESSELS

The pure blood is carried from the heart by a large artery called the aorta. Branch arteries are given off from this large artery, the branches in turn giving off succeeding branches. The branches divide and subdivide until they become very small and terminate in threadlike vessels, known as capillaries, which extend into all the organs and tissues.

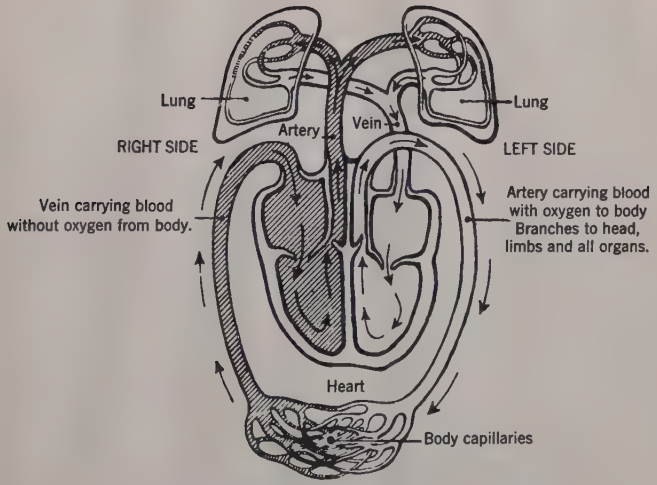

FIGURE 18.—Systemic and pulmonary circulation.

After the blood has furnished the necessary nourishment and oxygen to the tissues and organs of the body it takes on waste products, particularly carbon dioxide. The blood returns to the heart by means of a different system of blood vessels known as veins. The veins join the arteries through the capillaries and by a process just the reverse of that given for the arteries build up the return circulatory system. Very fine veins join, forming larger veins, which in turn join until the very largest veins are formed, returning the blood to the heart. In this course of the return of the blood to the heart it passes through the excretory organs, and certain waste products are removed. When

it reaches the heart, however, there still remains its load of carbon dioxide and some volatile waste matter that must be eliminated.

PURIFICATION OF BLOOD BY THE LUNGS

The heart may be likened to a four-cylinder pump, except that the cylinders do not discharge to a common outlet. When the blood returns to the heart it must be purified before it can be recirculated, so cylinder 1 draws the impure or venous blood from all parts of the body and passes it into the second cylinder. Cylinder 2 pumps the impure blood to the sponge-like blood vessels of the lungs, where the carbon dioxide and volatile waste products are exchanged for oxygen through the delicate walls of the air cells. Thus the blood is purified and ready to recirculate throughout the body.

Cylinder 3 draws the blood from the lungs back to the heart and passes it into the final cylinder, 4. Through the strong action of cylinder 4 the blood starts out on a new trip through the arteries. The time taken for the blood to make one complete circulation of the body averages about 1¼ minutes.

HEMORRHAGE OR BLEEDING

Hemorrhage or bleeding is a flow of blood from an artery, vein, or capillary.

When blood spurts from a wound in jerks and is bright red, an artery has been cut. The blood in the arteries comes direct from the heart and has the pulsating effect of the heart, which is forcing the blood throughout the body. Having been purified and received a fresh supply of oxygen, it is bright red.

When dark-red blood flows from a wound in a steady stream a vein has been cut. The venous blood is drawn back to the heart through the veins by constant suction; and the blood, having given up its oxygen and received carbon dioxide and waste products in its place, is darker red.

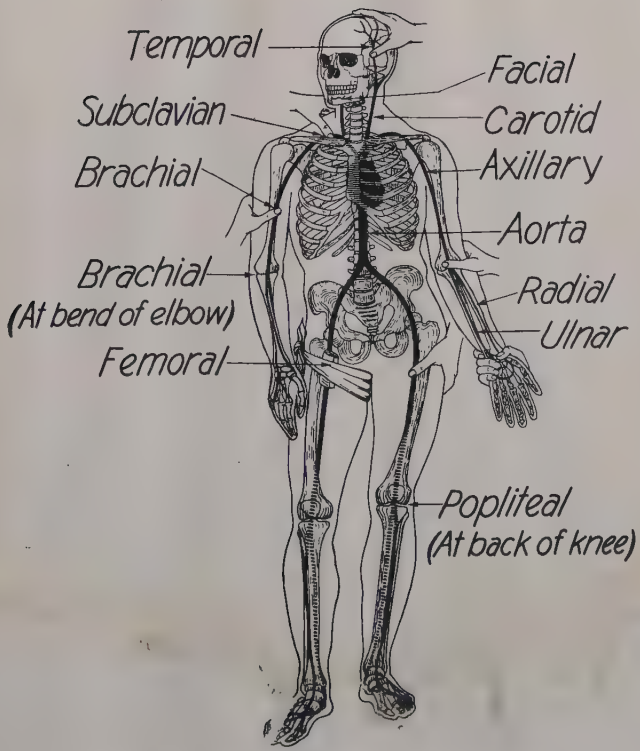

FIGURE 19.—Course of arteries and pressure points.

When blood just oozes from a wound capillaries have been cut.

When blood is oozing from a wound caused by capillaries being cut, there is no cause for alarm, as the amount of blood that can be lost is small; but if blood is spurting from a wound or flowing in a steady stream, it should be checked as soon as possible, or the patient may lose enough blood to endanger life or cause shock.

The loss of 1 to 2 pints of blood in an adult usually is serious, and the loss of 2 to 3 pints of blood may be fatal. At certain points in the body fatal hemorrhages may occur in a very short time. The cutting of the carotid artery or jugular vein, the two principal blood vessels in the neck; the cutting of the brachial artery or the basilic or cephalic vein, the principal blood vessel in the arm; or the cutting of the femoral artery or femoral vein, the principal blood vessels in the thigh, may cause hemorrhages that prove fatal in 1 to 3 minutes. Rupture of the aorta or vena cava, the main trunk blood vessels of the chest and abdomen, may cause fatal hemorrhage in less than one-half minute.

When blood is flowing through the body it is fluid, but as soon as a blood vessel is cut nature provides a safeguard by which the blood at the site of the wound thickens or clots and tends to stop the flow. If this did not occur the slightest scratch would result in loss of all the blood in the body. The blood of some persons will not clot. Such people are commonly called "bleeders," and they may bleed to death from slight injuries where blood vessels are cut.

A spurting stream of blood will not clot. For that reason arterial bleeding is extremely dangerous. To promote the formation of a clot in arterial bleeding, the flow of blood must be slowed to comparative rest. Pinching or compressing the blood vessel cuts down the flow, causes the walls of the blood vessel to adhere, and materially helps in forming a clot.

A sterile compress applied over a bleeding wound causes the blood to mat in the meshes of the gauze of the compress, and in most cases of venous bleeding will promote formation of a clot.

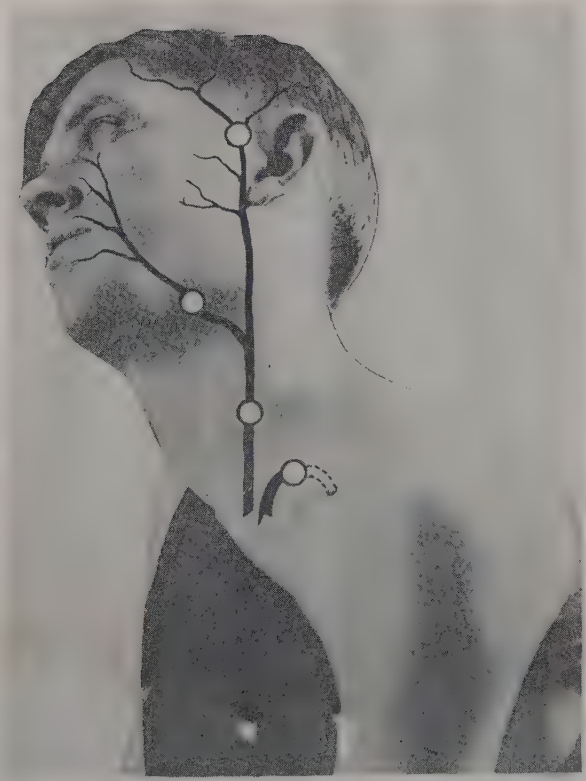

FIGURE 20.—Course of arteries and pressure points; head and neck.

In the case of a leg or arm, a simple constriction, placed below the wound on the side away from the heart will retard the venous blood flow and assist clot formation. Constrictions for control of venous bleeding should be loosened every 10 minutes the same as tourniquets.

A sterile compress applied over a wound accompanied by capillary bleeding in most instances controls the bleeding almost immediately.

FIGURE 21.—Course of arteries and pressure points; upper extremity.

Never apply cobwebs, tobacco, or waste in or on a wound to control bleeding. Never put any material other than a sterile dressing in contact with an open wound. The first-aid man is advised to use only pressure, position, and cold in controlling hemorrhage.

In severe bleeding place the patient in such a position that he will be least affected by the loss of blood. Lay him down with his head lowered (unless there is severe bleeding from the head or a fractured skull), so the brain will get as much blood as possible. He should be kept at rest, as movements of the body may interfer with clot formation or dislodge a clot formed. Give him plenty of fresh air, and give him water slowly if he is conscious. Keep him warm by covering and heated objects, but give no stimulants while he is bleeding, as they increase the force of the heart action.

METHODS OF CONTROLLING BLEEDING

Pressure

Arterial bleeding.—Use digital pressure and apply tourniquet over pressure point between the heart and wound. Apply sterile compress and bandage over wound, and for additional pressure (unless otherwise indicated) tie knots over wound.

Venous bleeding.—Constrict the part below the wound away from the heart side, if necessary. Apply sterile compress and bandage over wound, and for additional pressure (unless otherwise indicated) tie knots over wound.

Capillary bleeding.—Apply sterile compress and bandage over wound.

Position

Arterial and venous bleeding.—Elevate wounded part to retard the flow of blood. (Exceptions: Wounds of head where shock is present and there is no fracture of skull, sunstroke, or apoplexy.)

Cold

Arterial and venous bleeding.—Apply cold applications to body in the region of the injury (not into the wound), to retard the flow of blood. Of particular use in internal bleeding.

ARTERIAL BLEEDING

When an artery has been cut, pressure should be applied at the nearest available pressure point to control bleeding. (See figs. 19, 20, 21, and 22.) The pressure points are situated throughout the body along trunk arteries. The points where these arteries come close enough to the surface to be reached and are adjacent to bony structures so that pressure can be exerted on the arteries against the bones are the pressure points. There are 22 pressure points on the body—11 on each side. The

FIGURE 22.—Course of arteries and pressure points; lower extremity: *A*, Front view; *B*, back view.

arteries are tubes comparable to rubber tubing, and if pressure is made upon them against a hard structure the walls may be compressed so that the flow of fluid through them can be retarded or cut off the same as pressure on rubber tubing against a hard surface would lessen or stop the flow of water through such tubing.

Pressure can be applied to the pressure points by digital (finger or thumb) pressure and by a device used in first aid known as a tourniquet. Where a tourniquet is used digital pressure is applied first to limit the loss of blood while the tourniquet is being prepared and applied.

Tourniquets cannot be applied to all the pressure points on the body; and in severe bleeding from a wound controlled by a pressure point where a tourniquet cannot be applied, digital pressure must be maintained until the patient is put under a doctor's care and he directs the release of the pressure. (See table on p. 81 for pressure points available and not available for tourniquets.)

APPLICATION OF TOURNIQUETS

A tourniquet is an appliance used to check severe bleeding from an artery. The standard tourniquet usually is a piece of web belting about 1 inch wide and 36 inches long, with a buckle or snap-device catch to hold it tight when applied. The object to apply the pressure on the artery is placed under the belting as it is being tightened. If a regular tourniquet is not at hand, one can be improvised from a strap, belt, suspenders, handkerchief, towel, bandage, necktie, piece of brattice cloth, rubber tubing, or other suitable material. (Never use wire, cord, or anything that will cut into the flesh.)

A tourniquet should be long enough to encircle the limb. A hard pad or object of suitable size should be placed over the artery so that when the tourniquet is tightened it will press

768735 O—48——7

the pad or object against the artery, thereby stopping the flow of blood. The pad may be made of a smooth round stone, a cork, a piece of coal, or some object of similar shape, but it must be well-padded with cloth to keep it from bruising the skin and the walls of the artery.

A cravat bandage can be used to improvise a tourniquet. Fold it to form a narrow cravat and pass around the limb one or more times and tie it in a single knot. (See fig. 23.) Then make a reef knot a short distance above the single knot to form a loop between it and the single knot. Place the padded object over the pressure point. Insert a stick or similar object through the loop and twist until the bleeding stops. (See fig. 23.) After putting the stick into the loop, pull away from the body when twisting, to avoid bruising the flesh. If necessary, a small bandage may be looped over the end of the stick after the tourniquet has been tightened to prevent untwisting.

A tourniquet for arterial bleeding should be placed over a pressure point between the wound and the heart. (See table, pp. 81 to 83.) An assistant should apply digital pressure over a pressure point while the tourniquet is being prepared. A tourniquet should not be used if the bleeding can be readily checked otherwise, because it stops circulation of the blood in the limb. When circulation of the blood is cut off too long death of the tissues of the part may follow; therefore, loosen the tourniquet after it has been in place 10 minutes, but do not remove it. After a tourniquet has been in place tightened for several minutes, the part below the tourniquet gradually turns white and later bluish as the circulation is stopped. If on loosening the tourniquet at the end of 10 minutes bleeding or persists, tighten it again after a few seconds or until normal color returns to the part below the tourniquet. Never permit a tourniquet to remain tight longer than 10 minutes. The same precaution applies to constrictions made to control venous bleeding.

In all compound fractures of the extremities, apply a tourniquet (see fig. 23), but do not tighten it unless necessary. Be

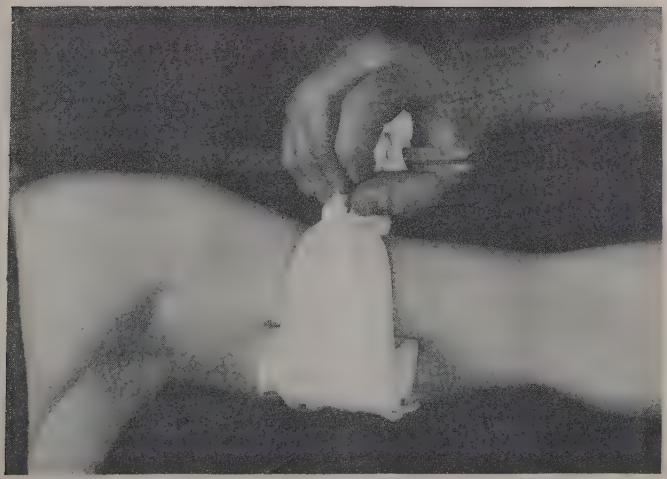

FIGURE 23.—Improvised tourniquet applied to arm.

sure not to cover the tourniquet with a bandage or bind it with splints so that it cannot be loosened and tightened. If spurting blood should be noted when a patient is being hand. transported, take time to check the bleeding. When treatment of a patient with a tourniquet or venous-control constriction in place is turned over to someone else or to an ambulance or physician, the first-aid man must make known to whoever receives the patient that a tourniquet or constriction has been applied and, if it is tight, how long it has been tight.

FIGURE 24.—Pressure points: *A*, Temporal pressure point; *B*, carotid pressure point; *C*, brachial pressure point; *D*, femoral pressure point.

ARTERIES AND PRESSURE POINTS

HEAD AND NECK

Artery	Course	Point on which to make pressure
Temporal (branch of the carotid).	Upward over head ½ in. in front of ear.	Against skull immediately in front of ear. Tourniquet can be applied by passing around head. Usually dressing for wound of head will permit placing control object beneath cover dressing bandage to make pressure on artery, if wound is not at the same location.
Facial (branch of the carotid).	Diagonally across face from just below angle of lower jaw toward nose.	Angle of lower jaw where artery crosses jawbone from the neck. Tourniquet cannot be applied. Must be controlled by digital pressure, when necessary.
Carotid	From upper outer edge of breastbone to angle of jaw.	Deep down and back, an inch to the outer side of Adam's apple. Tourniquet cannot be applied. Must be controlled by digital pressure. If wound presents end of artery the thumb and first finger covered with sterile gauze can grasp and hold the end of the artery.

ARTERIES AND PRESSURE POINTS—Continued

UPPER EXTREMITY

Artery	Course	Point on which to make pressure
Subclavian	Across middle of first rib to armpit.	Deep down and back over center of collarbone against first rib. Shoulder should be drawn down. Tourniquet cannot be applied. Must be controlled by digital pressure.
Axillary (continuation of subclavian).	Axillary space or armpit.	For arm torn off at shoulder control at subclavian pressure point. Tourniquet cannot be applied. If end of artery is exposed in wound, cover thumb and first finger with sterile gauze and grasp end of exposed artery. If artery cannot be seen, pack cavity with sterile gauze and bandage tightly in place. Tourniquet for armpit: Place the center of a narrow cravat in armpit over a well-padded hard object. Cross ends on shoulder over a pad. Carry ends around back and chest to opposite armpit and tie over a pad. To tighten insert a small stick or similar object under cross of bandage on shoulder, and twist until bleeding is controlled, then anchor. Tourniquet may be loosened by simply untwisting.
Brachial (continuation of axillary):		
Upper portion	Descends along inner side of large muscle on front of arm to bend of elbow.	Along side of large muscle inner side of arm 1 to 3 inches below armpit about the inner seam of coat sleeve, making pressure against arm bone. Tourniquet can be applied.
Lower portion	At crease of bend of elbow.	Against arm bone just above crease of bend of elbow. Tourniquet can be applied. To be used only when pressure point on upper portion of brachial artery cannot be used.
Radial (branch of brachial).	Descends along thumb side of forearm.	At wrist, palm surface on thumb side. Tourniquet can be applied.

Ulnar (branch of brachial).	Descends along little finger side of forearm.	At wrist, palm surface on little finger side. Tourniquet can be applied. To be used only when pressure point on upper portion of brachial artery cannot be used. Principal branches of the radial and ulnar arteries unite in palm of the hand. For wounds of hand with severe arterial bleeding both pressure points at wrist must be used at the same time.
LOWER EXTREMITY		
Femoral:		
Upper portion	From pelvis in groin midway on line between crotch and crest of hip.	Using large object, very deep pressure above center of groin midway on a line between crotch and crest of hip. Tourniquet difficult to apply and hold in place. If leg is torn from body or cut off close to hip and end of artery is exposed in wound, cover thumb and first finger with sterile gauze and grasp end of exposed artery. If artery cannot be seen pack cavity with sterile gauze and bandage tightly in place.
Lower portion	Down thigh from center of groin, turning inward around thigh to back of knee.	Against bone of thigh between muscles about 3 inches below crotch along line of inner seam of trousers. Tourniquet can be applied.
Popliteal (continuation of femoral).	Down center of space at back of knee joint.	About center of bend of knee. Tourniquet can be applied. Pressure object must be small enough to go between tendons at back of knee joint. To be used only when pressure point on lower portion of femoral artery cannot be used.

INTERNAL BLEEDING

Internal hemorrhage may result from a deep wound that cuts large blood vessels of the chest or abdominal cavities or one or more of the internal organs, or from rupture of internal blood vessels due to deep bruises. In internal hemorrhage the bleeding may not be seen but the condition may be determined by the symptoms presented by the patient.

The symptoms of internal bleeding are faintness, cold skin, pale face, dilated pupils, thirst, feeble and irregular breathing, sighing, clouded vision, weak and rapid pulse, dizziness, and later loss of consciousness. The severity of the symptoms depends on the amount and rapidity with which blood is lost.

Lay the patient down, with head lower than the body, except for fracture of skull and apoplexy, when head is raised. Apply ice or cold cloths to the body at the point from which you think the bleeding comes. Do not give stimulants unless absolutely necessary. You may give ice water or cold water slowly if patient is conscious. Keep patient covered, and obtain medical aid as quickly as possible.

THE NERVOUS SYSTEM

The various parts of the body and the organs controlling the body functions are kept in touch with each other by the nervous system. The nervous system really consists of two separate but interconnected and coordinated systems, the cerebrospinal system and the sympathetic system.

The cerebrospinal system is composed of the brain and spinal cord. The brain is a collection of nerve centers, each center being a central station for some part of the body, much like a central telephone station, with trunk lines or nerves connecting the parts of the body with their particular centers. Leaving the brain, these trunk nerves are bundled together into the spinal

cord. As the spinal cord passes down through the opening in the center of the backbone or spinal column, branches are given off to all parts and organs of the body.

Nature has tried to protect the delicate nervous system by enclosing the brain in a bony case (the skull) and the spinal cord by enclosing it in the center of the bony vertebrae. Injuries to the head, especially when the skull is fractured, may cause serious damage to the delicate nervous tissue of the brain. Likewise, fractures of the backbone or spine may cause the spinal cord to be cut or pinched so severely as to result in paralysis below the point of injury. Cutting or severe pinching of a trunk nerve after it has left the spinal cord, as in the arm or leg, will cause paralysis below the point of injury. The nerves entering and leaving the spinal cord are mainly of two types—sensory nerves entering the cord, which convey impressions of sensations, such as heat, cold, touch, and pain from different parts of the body to the brain; and motor nerves, leaving the spinal cord, conveying impulses from the brain to the muscles causing movement.

The sympathetic system consists of a series of nerve centers called ganglions in the chest and abdominal cavity along the spinal column. Each of these ganglions or nerve centers, although interconnected with the cerebrospinal system, presides over and controls vital organs and vital functions. This system is not under control of the will, but through it involuntary muscles are stimulated to act alike during periods when we are awake and when we are asleep. Thus the heart beats, we breathe, the blood pressure is maintained, we digest our food, and the excretory organs function independently of any effort on our part.

The nervous system plays a very important part in conditions of physical shock that result from injuries or exposure to the exciting causes of shock.

PHYSICAL SHOCK

Physical shock is a state of collapse or prostration that interferes with the normal action of the heart, respiration, and circulation. This condition is probably due to derangement or lack of proper balance within the sympathetic nervous system that controls these vital functions.

CAUSES OF PHYSICAL SHOCK

Severe or extensive injuries.
Severe pain.
Loss of blood.
Surgical operations.
Severe burns.
Accidents due to electricity or gas.
Certain illnesses.
Poisons taken internally.
Exposure to extremes of heat or cold.
Seeing own injuries or injuries of others.
Fright.
Anger.
Joy.

The state of shock may develop rapidly or may be delayed and manifest itself hours later. Shock occurs to some degree after every injury. It may be so slight as not to be noticed. It is a serious condition in many injuries and frequently results in death where the injuries received ordinarily would not prove fatal.

Always look for shock in rendering first aid, and at the first sign of it start shock treatment.

SYMPTOMS OF PHYSICAL SHOCK

APPEARANCE OF PATIENT

Face pale and has an anxious or dull expression.
Eyelids droop if open, and the eyes are dull and pupils large.

EXAMINATION OF PATIENT

Patient may be partly or totally unconscious.
Skin is cold and covered with a clammy sweat, particularly the hands and forehead.
Patient feels cold and may have a chill. Temperature is subnormal.
Pulse is weak and rapid if it can be felt.
Breathing is shallow and may be irregular.
Patient is stupid and takes little interest in things about him. If internal bleeding is present patient will be restless; and if conscious, complains of clouded vision, dizziness, and thirst.
He may answer questions slowly or apparently fail to understand.
Nausea and vomiting often occur.

Some of the things known to take place within the body in cases of shock bear directly on the symptoms presented. The most important thing that occurs in shock is a decided drop in the blood pressure, believed to be due to the loss of control by the sympathetic nervous system over certain small blood vessels. Meanwhile the capillaries and blood vessels in the interior of the body, particularly in the abdominal cavity, dilate and become engorged with blood. This removal of blood from general circulation causes the blood pressure to fall and decreases the volume of blood passing through the heart and lungs.

As a large amount of blood goes to fill the dilated vessels within the body the circulation near the surface is decreased, causing the skin to become pale, cold, and clammy. Likewise, many organs of the body suffer from a decrease in the normal blood supply; in the eyes, for example, this cause drooping lids and dullness.

With the fall of the blood pressure and the unusual amount of blood drawn from the circulation to fill the dilated and engorged blood vessels within the body, less blood returns to the

heart for recirculation. In an effort to overcome the decreased volume and yet send blood to all parts of the body, the heart speeds its action, pumping faster but with a much lowered quantity, and the pulse is rapid and weak.

Likewise, the decreased amount of blood passing through the lungs requires less air to oxygenate the smaller amount of blood; hence, the respiration becomes shallow and feeble.

The brain, as well as other organs, suffers from a decreased blood supply and does not function normally; the patient's powers of reasoning, thinking, and expression are dulled.

Nausea and vomiting are believed to be due to congestion and engorgement of the blood vessels within the abdominal cavity.

TREATMENT OF PHYSICAL SHOCK

Shock is a dangerous condition that should be given prompt attention and medical aid obtained as soon as possible.

Place patient in a comfortable position lying down. The head should be on a level with the body if on the ground (exceptions, see Fracture of Skull, p. 172; unchecked severe hemorrhage from the head; Sunstroke, p. 95; and Apoplexy, p. 96). If there is a moderate slope to the ground where patient is lying, place head downgrade. Where patient is on a stretcher or body splint, elevate feet end of stretcher or body splint at least 6 inches.

Remove all foreign bodies from the mouth, such as false teeth, tobacco, gum, and like material, and cleanse the mouth of mucus or phlegm. See that tongue is forward and not back over the windpipe.

Loosen tight clothing from waist and [illegible]

If nausea and vomiting are present, turn head to one side so vomited matter will flow from the mouth. Keep mouth and face wiped clean.

Permit patient to have plenty of fresh air.

Wrap patient in blankets or other covering, clothing, brattice cloth, or other available material as early as possible. The entire body except head should be covered, but care should be taken not to contaminate injuries. Blankets and other covering material must be placed under the patient as well as over him to prevent loss of heat to the ground or floor.

Maintain heat under covering by applying heated objects, such as hot-water bottles, heated bricks or stones, along body, between the legs, and in the armpits. Heated objects should always be wrapped and tested before being applied, as a person in shock frequently cannot make known that the heated objects are hot enough to burn him.

Stimulants should be given to the patient *by mouth if he is conscious* or *by inhalation if he is unconscious*, unless there is unchecked severe bleeding, internal bleeding, fracture of the skull, sunstroke, or apoplexy. In first aid the stimulants recommended for use by the mouth if the patient is *conscious* are aromatic spirits of ammonia (1 teaspoon in one-half glass of water), hot coffee, hot tea, or hot water. Hot coffee, tea, or water should be as warm as the patient can drink it and should be given in small quantities, not to exceed 1 cup in one-half hour. Aromatic spirits of ammonia is best given by sips and should not exceed one-half glass when mixed with water during a 20-minute period. If too much liquid is given, it may cause the patient to vomit. If patient is *unconscious*, give him nothing by the mouth, as he may not swallow and the substance may pass into the windpipe and choke him. Aromatic spirits of ammonia can be given to an unconscious person in a state of shock by pouring it on a piece of gauze or cloth and placing it under his nose for 30 to 40 seconds. Aromatic spirits of ammonia should be given by inhalation at about 5-minute intervals. Aromatic spirits of ammonia should be tested before use, either by mouth or inhalation. Mistakes have been made where strong ammonia has been used instead of aromatic spirits of ammonia.

Rubbing the inner sides of the patient's uninjured arms and

legs toward body with a slow, firm stroke is believed to help in promoting return flow of the circulation. Rubbing should be done beneath the covering and care taken not to expose the patient to drafts or cold.

Inhalation of oxygen, if available, often is of service in treating shock.

The most important thing in treating shock is to restore the body warmth by adequate covering over and under the body, heated objects within the covering, and warm drinks, if the patient is conscious. There is a decided relationship between body temperature and blood pressure, heart action, and respiration. As body temperature returns to normal the sympathetic nervous system regains its control over the vital functions, restoring circulation and improving heart action by decreasing the heart speed and increasing the heart volume; respiration becomes deeper and more regular.

Next to reestablishing normal body temperature by warmth, the position of the patient plays an important part in caring for shock. If the patient is lying down and the head is on a level with or lower than the feet, the flow of blood to and from the overworked heart is greatly aided. By taking advantage of gravity the blood in the dilated and engorged blood vessels in the abdominal cavity tends to drain back to the heart, not only increasing the amount of blood reaching the heart but relieving part of the strain on the heart due to its attempt to supply all parts of the body with the required amount of blood. Never permit a patient in a state of shock to sit up, as the additional strain on the circulation and heart will greatly increase the state of shock.

Stimulants used in first aid play a part in combating shock, but their effects are more or less transient. They are more effective in mild cases of shock than in profound shock. Hot coffee and hot tea, both of which contain caffein, have a more prolonged effect than aromatic spirits of ammonia but require

a longer time for absorption. Aromatic spirits of ammonia is a rapid but transient stimulant.

Rubbing is the least effective of the shock treatments, and time should not be devoted to it if more important first-aid care is required.

As long as evidence of shock is present, shock treatment should be continued. Patients in a state of shock tend to relapse, even after their condition has greatly improved. Relapse should be watched for and combated by renewed shock treatment. After he has recovered from shock of even short duration, the patient should be kept lying down and quiet so that as little strain as possible is placed on the circulation and heart action.

Where hemorrhage accompanies shock, special care is required to determine the seriousness of the bleeding. The lowered blood pressure and feeble heart action present in shock keep a wound from bleeding freely; but as the effects of shock wear off, normal blood pressure and heart action return, and if the bleeding has not been checked properly it may become serious. Recheck sources of hemorrhage in shock cases at frequent intervals.

Patients in a state of shock from different causes require different care, especially with regard to the position of the head, the application of warmth, and the use of stimulants. A general classification of treatment according to symptoms follows.

SHOCK WHERE FACE IS FLUSHED OR RED AND PULSE IS FULL AND STRONG

Head must be raised and no stimulant given.

If the body is hot and dry, the patient must be removed to a cool place, clothing removed, and cold applications made to the body to reduce the temperature. (See Sunstroke, p. 95; Apoplexy, p. 96; and Fracture of the Skull, p. 172.)

SHOCK WHERE FACE IS PALE AND PULSE IS RAPID AND WEAK

Usual shock treatment after checking bleeding if present, unless there is a fracture of the skull, when head should be raised and no stimulants given.

SHOCK WHERE FACE IS BLUE AND PULSE IS USUALLY RAPID AND WEAK

The blue or dusky appearance is due to lack of oxygen in the blood. Gas poisonings, electric shock, certain poisons taken internally, asphyxiation, strangulation, and certain illnesses present either difficult or absent respiration and may bring about this condition. Besides the usual shock treatment, artificial respiration is needed.

FAINTING

Fainting is a temporary loss of consciousness due to an insufficient supply of blood to the brain and is a mild form of physical shock. Fainting may be caused by an injury, the sight of blood, exhaustion, weakness, heat, lack of air, and the emotions, such as fright or joy. Some persons faint much more readily than others.

SYMPTOMS

The patient feels weak and becomes dizzy, black spots appear before his eyes, his face becomes pale and lips blue, and his forehead is covered with perspiration. He then sinks back in his seat or falls to the ground unconscious. The pulse is rapid and weak, and the breathing is shallow. The above symptoms usually occur in a few seconds.

Fainting is one of the more frequent occurrences that require first aid. A patient lying down seldom faints; therefore, in

first aid it is always best to have the patient in the lying position. It is much easier to make an examination and to dress most injuries, and it will ward off fainting in many instances. An injured person being examined in a sitting or standing position may faint suddenly and fall, causing either an aggravation of his original injuries or additional injuries. Where the early signs of fainting are noted, unconsciousness may be prevented by lowering the head immediately. If a person is sitting, bend the body at the waist, and bring the head down between the knees. Better still, if space is available, lay the person down with the head low.

TREATMENT

See that the patient is lying down with *head low.*
Cleanse mouth.
Loosen tight clothing at neck and waist.
Allow the patient to have plenty of fresh air.
Give aromatic spirits of ammonia by inhalation.
If body surface feels cold, cover to retain heat.
When consciousness returns, give aromatic spirits of ammonia, 1 teaspoon in one-half glass of water, in sips. A patient who recovers consciousness after fainting should not be permitted to rise immediately but should be kept lying down and quiet for at least one-half hour.
If unconsciousness is prolonged, apply the full treatment for physical shock, and call a physician.

HEAT EXHAUSTION

Heat exhaustion is collapse from the effect of heat, from the sun or any other source. It occurs more frequently when the humidity is high. Heat exhaustion is a serious condition, and proper treatment should be given at once.

768735 O—48——8

SYMPTOMS

The patient is seldom unconscious but may complain of feeling very weak. His face is pale and anxious looking and covered with a cold perspiration. He may complain of feeling chilly. The pulse is rapid and thready, and the breathing is shallow with little chest expansion.

TREATMENT

The treatment for heat exhaustion is the same as that for physical shock.

The patient should be lying down with the *head low.*
Cleanse mouth.
Wrap body in coverings.
Apply hot applications.
Use stimulants.
Rub extremities.
Obtain services of a physician.

HEAT CRAMPS

Heat cramps are painful spasms of muscles, especially those of the abdomen and limbs, after prolonged exposure to high temperatures while engaged in strenuous labor. The spasmodic cramps experienced may be simply a slight cramp in the abdomen or muscles of an extremity or may be so severe as to cause convulsions. Attacks may be of short duration or may last 12 to 24 hours and after being relieved the spasms may be renewed by exposure to a cold draft or exertion.

Nature attempts to rid the body of persons working in high temperatures of excess heat through sweating and the evaporation of the sweat. Profuse sweating not only removes moisture from the body but a considerable amount of the salt content of the body fluids is lost in the sweat. Loss of the salt content

from the body fluids excites irritation of the muscles, resulting in the spasmodic cramps.

In first aid, prevention of heat cramps is much more important than treatment, which is mainly medical. Men at hard work in high temperatures should drink adequate amounts of cool water (10 to 15 glasses a day) to replace the fluid lost in perspiration, and at the same time replace the excreted salt by adding to each glass of water a good-size pinch of salt or a salt tablet, such as is supplied by a dispensing cabinet near drinking fountains in many large plants. They should limit their diet to light, easily digested food and avoid heavy, fatty food. Constipation should be avoided. Working clothes should be light and porous to promote evaporation.

The treatment for mild heat cramps is increased salt intake, warm baths, and rest. If the cramps are severe and persist, medical care is necessary.

SUNSTROKE

Sunstroke is a sudden attack of illness from prolonged exposure to the direct rays of the sun or to other high temperatures, particularly of those engaged in hard labor in confined quarters. It may occur without exposure to the direct rays of the sun.

SYMPTOMS

The attack is sudden, and the patient becomes unconscious rapidly. Unconsciousness may be preceded by intense headache and dizziness. The face is red and flushed. The skin is hot and dry, with perspiration absent. The pulse is slow and full or even may be bounding in character. Breathing is labored and of a snoring type. The pupils of the eyes are enlarged but of equal size.

TREATMENT

Owing to the excessive body temperature, treatment centers around reducing the high temperature as quickly as possible.

Remove the patient to a cool place and lay him down with the *head raised* by placing a pad under the shoulders and head to reduce the flow of blood to the brain.

Take off as much clothing as necessary and apply cold applications to the body and head. The patient can be wrapped in a sheet kept wet with cold water or placed in a cold bath. If ice is available, the body can be rubbed with it and an ice cap placed on the head.

Rub the patient's limbs continuously to promote circulation and prevent shock.

Continue cold applications until consciousness returns or until body temperature returns to normal. Watch for signs of physical shock as the temperature drops. If physical shock occurs, treat accordingly.

When the patient is conscious, give him all the cool water he desires.

Give no stimulant.

If skin becomes hot and dry again, renew cold applications.

Sunstroke is a very dangerous condition and medical care should be obtained as early as possible.

APOPLEXY

Apoplexy, cerebral hemorrhage, or stroke is the spontaneous upture of a blood vessel within the skull, causing a hemorhage into the brain tissues. It usually occurs in elderly persons.

Besides the spontaneous rupture of a blood vessel within the rain, blows to the head may cause cerebral hemorrhage. In l head injuries, symptoms of cerebral hemorrhage should be oked for and if present the treatment for apoplexy should be lministered.

The patient becomes unconscious gradually or suddenly. Unconsciousness may be preceded by a sense of pressure and pain within the head. When the hemorrhage occurs, blood from the ruptured blood vessel accumulates in the part of the brain near the rupture; as the accumulation increases, there is pressure on the substance matter of the brain usually leading to paralysis of the part of the body controlled by that section of the brain where the pressure is exerted.

SYMPTOMS

The patient usually is unconscious. The face is flushed and warm but sometimes may appear ashen gray. The pulse at first is slow and strong but later becomes rapid and weak. Respiration is slow and snoring in type, the lips and cheeks puffing out at each expiration. *The pupils of the eyes are unequal in size,* and often one eyelid droops. Frequently the mouth is drawn to one side, and if the patient tries to talk he mumbles out of one side of the mouth. Usually only one side of the body is paralyzed.

TREATMENT

Have the patient lying down with the *head well raised* by a pillow or good-size pad under the shoulders and head.

Allow plenty of fresh air, but keep the patient warm with covers.

Apply cold applications or an ice bag to the head.

Give no stimulants.

Keep the patient absolutely quiet, and do not move him unless necessary.

Obtain medical care as soon as possible.

THE SKIN

The skin forms the outside covering of the exposed parts of the body and at the openings joins the mucous membrane,

similar tissue that lines all the passages from the outside into the body.

The skin includes the special organs for touch, the tactile corpuscles, the sweat glands (part of the excretory system), the sebaceous glands (secreting an oily fluid that keeps the skin soft and pliable), and the hair follicles, from which hair is developed. The nails and hair are appendages of the skin.

When the skin on the outside of the body and the mucous membrane lining the passages into the body from the outside are unbroken, they afford protection from most infections, bacteria, or germs. Germs that cause what is commonly known in first aid as infection seldom enter the body and increase in large enough numbers to cause infection when the skin or mucous membrane is unbroken. Therefore, the skin and mucous membrane afford our first line of defense against infection

INFECTION

Great numbers of small vegetable organisms known as bacteria, or more commonly as germs, are present everywhere in nature except in sterilized articles. These minute organisms are far too small to be seen by the eye alone and are visible only through high-power microscopes. Some of the smallest organisms have never been seen, because present microscopes do not provide magnification high enough to make them visible.

All germ life is not harmful to the human body. Many types of germs are necessary to life and aid nature and man to exist; however, there are types of germs that cause infection, when they gain entrance into the body and increase in number under the conditions suitable for growth existing beneath the skin.

Whenever the skin is broken, no matter how slight the break, germs may enter and an infection may develop. Therefore, every wound where the skin is broken should receive prompt medical attention. As means are not available for determining the type of germs that may be on any article, only sterile objects

should be in contact with an open wound. If germ life has been carried into an open wound by the object causing the break in the skin, nature attempts to wash out the germs by the flow of blood, but as will be shown later some types of wounds do not bleed freely.

Statistics show that about 1 open wound in every 20 shows evidence of infection, and where open wounds do not receive early first aid or medical care the rate of infection is nearly doubled.

OPEN WOUNDS

An open wound is any break in the skin. It may range from a pin puncture or scratch to an extensive cut, tear, or mash. An open wound may be only the surface evidence of a more serious injury to deeper structures, such as fractures, particularly in head injuries involving fracture of the skull. In first aid, open wounds are divided into four classifications.

ABRASIONS

Abrasions are wounds caused by rubbing or scraping. These wounds are not usually deep, but a portion of the skin has been removed, leaving a raw, bleeding surface. The bleeding in most abrasions is capillary only. Abrasions are easily infected owing to the amount of underskin surface exposed.

INCISED WOUNDS

Wounds produced by a sharp cutting edge such as a knife, a piece of glass or metal, or a sharp edge of coal, rock, or slate are incised wounds. The edges of such wounds are smoothly divided without bruising or tearing. Incised wounds bleed freely and are not so liable to infection as wounds of other types.

LACERATED WOUNDS

Lacerated wounds are those presenting ragged edges from being torn or mashed by blunt instruments, machinery, or rough surfaces. These wounds, in which the blood vessels are torn or mashed, do not bleed as freely as incised wounds. However, the ragged and torn tissues, with the foreign matter that is often forced or ground into the wound, make the danger of infection greater than in incised wounds.

PUNCTURED WOUNDS

Punctured wounds are produced by pointed instruments, such as needles, splinters, nails, or pieces of wire. Such wounds usually are small but may be very deep. Most of the articles causing punctured wounds are soiled, and matter causing infection often is introduced deep in the tissues. The small openings in punctured wounds and the few blood vessels cut prevent free bleeding. The danger of infection in punctured wounds is far greater than in any other type of wound.

GENERAL DIRECTIONS FOR CARE OF OPEN WOUNDS

The chief duties of a first-aid man in caring for an open wound are to check hemorrhage and to prevent germs from getting into it. If germs do not enter there will be no infection, and the parts will heal quickly.

Rip or cut the clothing so that the injury may be seen. If loose foreign particles are in or around the wound they may be wiped away with sterile gauze. Always wipe away from the wound, not toward it. Do not attempt to remove a foreign object embedded in the wound. Leave that to the doctor, as it may aid him in determining the extent of the injury and the involvement of deeper parts.

Do not touch the wound with your hand, clothing, or anything that is not sterile, and do not pour water or any drug into or on it. Place a sterile bandage compress or sterile gauze over the wound, and tie it in place. All bandage compresses or sterile gauze dressings should be protected by an outer dressing made from a cravat or triangular bandage, except dressings for wounds of the eye, nose, chin, finger, and toe, or compound fractures of the hand and foot when splints are applied.

Care should be taken to make all sterile dressings wide enough to cover completely the wound and an area on each side of it. If the cravat bandage is already folded, it should be opened enough to cover the entire sterile dressing.

Unless otherwise specified, the knots of the sterile bandage compress and cover bandage should be tied over the wound on top of the pad of the compress to assist in checking the bleeding.

Where there is severe bleeding from an artery, always check it by digital pressure and then by the use of a tourniquet when necessary if a tourniquet pressure point is available. *Never* forget the danger of leaving a tourniquet tight longer than 10 minutes.

Usually considerable shock follows wounds, especially if much blood is lost. Shock should be treated promptly.

PRECAUTIONS AGAINST INFECTION OF WOUNDS

Remember that germs are found everywhere—on the clothing, on the surface of our bodies, on our hands and fingers, in our mouths, in dust, in water, and on all kinds of unsterilized instruments. These germs may irritate the tissues and destroy them, or they may get into the circulation and cause blood poisoning.

To prevent infection, keep away from wounds your hands, clothing, and everything else except sterile dressings. Cover the wound as soon as possible with a sterile bandage compress (or

with sterile gauze) and a triangular or cravat bandage, and send the patient to a physician for additional care.

Leave the work of cleansing the wound to the doctor. The Bureau of Mines suggests that antiseptics be used by first-aid men only when the plant or mine physician supplies the drugs, gives instructions how to use them, and assumes responsibility for their use.

BANDAGING

Bandage wounds firmly but never tightly. A tight bandage may interfere with the blood supply and thereby cause serious results. In bandaging the arms or the legs, leave the tips of the fingers or toes uncovered where possible, so that they may be seen. This permits easy examination to determine if bandages are too tight. Always place the part to be bandaged in the position in which it is to be left. Remember that swelling frequently follows an injury and that a tight bandage may cause serious interference with the circulation to the part. On the other hand, do not apply a bandage too loosely, as it may slip off and expose the wound. If the patient complains that the bandage is too tight, loosen it and make it comfortable but snug. Never apply a wet bandage, except where picric-acid gauze and cover bandage are used in treating burns. These dressings are always applied loosely.

DRESSINGS FOR WOUNDS AND BLEEDING

EXTENSIVE WOUNDS AND BLEEDING OF SCALP

A wound or wounds involving a large area of the scalp may be dressed by covering the injury with a piece of sterile gauze or a large sterile bandage compress. When a bandage compress is used, carry the ends under the chin and up over the head and tie on top of the compress pad. Then apply a triangular bandage over the head, having the base fit snugly across

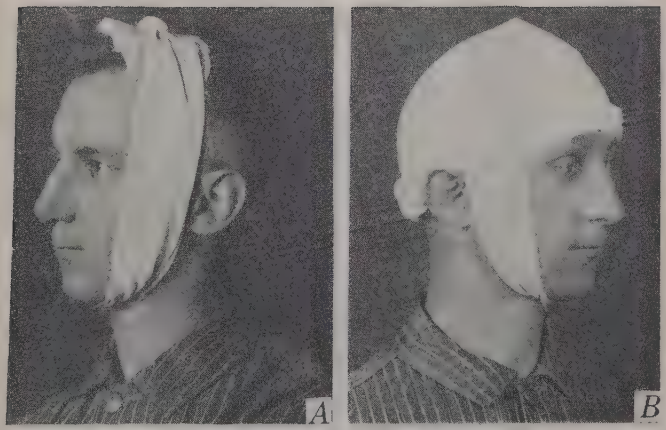

FIGURE 25.—Dressing for extensive wounds of scalp: *A*, Compress applied; *B*, dressing complete.

the forehead just above the eyebrows and the apex of the bandage at the back of the neck. Bring the two ends of the bandage around the head just above the ears and cross under the bony prominence on the back of the head, then return the ends to the middle of the forehead and tie just above the eyebrows. The apex should be folded up and tucked snugly over the crossed ends at the back of the head. If sterile gauze is used instead of a bandage compress, care must be taken to keep it in place while the cover bandage is being applied. (See fig. 25.)

WOUND AND BLEEDING OF SCALP, TEMPLE, EAR, OR FACE

Apply the pad of a sterile bandage compress over the wound; carry one end under the chin and the other end over the top of the head; cross the ends on the opposite side; carry one end around the front and the other end around the back of the head and tie over the compress. If the wound is on the back of the ear, place the compress between the wound and the head. Cover the compress with a medium-wide cravat bandage applied in the same way. (See fig. 26, *A* and *B*.) If the wound is on the front of the face, the bandage compress and cravat bandage should be crossed behind the ear, on the side opposite the injury, brought around the forehead and back of head, and tied. (See fig. 26, *C*.)

WOUND AND BLEEDING OF FOREHEAD OR BACK OF HEAD

For a wound of the forehead, apply the pad of a sterile bandage compress over the injury, and hold it in place by passing the ends of the bandage compress around the head above the ears, crossing them behind under the bony prominence, bringing them forward, and tying them in front over the wound. Then apply the center of a narrow cravat bandage over the pad, take the ends to the back of the head, cross them, bring to the front, and tie. (See fig. 27.) This dressing also may be used for a wound on the back of the head, the bandage compress being applied over the wound and tied, then covered with a cravat bandage, the center being placed over the compress, and the ends taken around the head and tied over the compress pad.

INJURIES OF EYE

For all injuries to the eye a sterile bandage compress should be used, as follows: Place the center of a bandage compress over the injured eye, carry the end on the injured side below the

FIGURE 26.—Dressing for wounds of scalp, temple, ear, or face: *A*, Dressing for wound of scalp, temple, or ear; *B*, bandage crossed over uninjured temple; *C*, dressing for wound of face.

FIGURE 27.—Dressing for wound of forehead.

FIGURE 28.—Dressing for injury of eye.

ear to the back of the head, and carry the other end above the ear on the opposite side; tie somewhat toward the injured side below the bony prominence on the back of the head. Bring both ends over the top of the head, passing the longer end under the dressing at the temple on the uninjured side. Then slide it in front of the uninjured eye, and pull it tightly enough to raise the dressing above the uninjured eye and tie to the other end on top of the head. (See fig. 28.)

FIGURE 29.—Dressing for wound or fracture of nose.

FIGURE 30.—Dressing for wound of chin.

WOUND AND BLEEDING OF NOSE

For a wound of the nose, split the tails of a sterile bandage compress. Then apply the pad of the compress to the wound and cross the tails, passing the ends of the bandage above and below the ears on each side and tying them back of the head. (See fig. 29.)

Usually nose bleeding is unimportant, but it may endanger life. The affected person should be kept in a sitting position,

with the head thrown slightly back. Applying firm pressure to both sides of the nose by grasping it between the first finger and thumb will control the hemorrhage in a number of cases. Have the patient avoid blowing the nose for several hours. If bleeding persists, procure medical attention.

FIGURE 31.—Dressing for wound of neck or throat.

WOUND AND BLEEDING OF CHIN

Split the tails of a sterile bandage compress; apply the pad to the wound and cross the tails, passing the ends above and below the ears on each side and tying them on the back and top of the head. (See fig. 30.)

WOUND AND BLEEDING OF NECK OR THROAT

Apply the pad of a sterile bandage compress to the wound, pass the ends around the neck, and tie over the wound. Then place the center of a narrow cravat bandage over the compress, take the ends around the neck, cross them, bring them around the neck again, and tie loosely. (See fig. 31.) If bleeding of the neck or throat is severe, it may be checked by pressure of the fingers wrapped with sterile gauze, if it is available, and placed directly in the wound.

WOUND AND BLEEDING OF SHOULDER

For wound and bleeding of the shoulder apply the pad of a sterile bandage compress over the wound, bring the ends under the armpit, cross, carry to the top of compress, cross, carry one end across the chest and one end across the back, and tie in the opposite armpit. Cover with a triangular bandage, along the base of which a hem has been folded, as follows: Place the apex high up on shoulder, place the base below the shoulder on the upper part of the arm, and carry the ends around the arm and tie them on the outside. To hold the bandage in position, place the center of a cravat bandage under the opposite armpit, carry the ends to the shoulder over the apex, tie a single knot (see fig. 32), and then fold the apex over and complete the knot. The forearm should be placed in a sling made of an open triangular bandage, as shown in figure 12, *A*.

WOUND AND BLEEDING OF ARMPIT

Apply the pad of a sterile bandage compress over the wound, crossing the ends over the shoulder and tying under the opposite arm. If severe hemorrhage is present, place some hard material, about the size of an egg, such as a piece of coal, stone,

768735 O—48——9

FIGURE 32.—Dressing for wound of shoulder.

or wood, covered with cloth, over the pad of the compress, and push it well up into the armpit, holding it in place by a narrow cravat bandage. The center of the narrow cravat bandage is placed over the hard material, the ends being brought over the shoulder and crossed. Then pass the ends around the chest and back and tie them under the opposite armpit. Then bring the arm down and secure it firmly to the chest wall by a narrow cravat bandage passed around the arm and chest and tied securely on the opposite side. Place forearm in a sling made of an open triangular bandage. (See fig. 33, *A* and *B*.)

ARM TORN FROM BODY

When an arm has been torn from the body at the socket, there is profuse bleeding from the larger blood vessels that are severed; therefore treatment should be prompt. Cover your hand thoroughly with sterile gauze, if it is available, and pass the hand right up into the wound and pinch the blood vessels. An assistant should make digital pressure over the subclavian artery to assist controlling hemorrhage temporarily. Then pack the wound with sterile gauze and bandage firmly. However, if there is no gauze at hand, do not wait, but place your fingers in the wound and pinch the blood vessels. While doing this have an assistant obtain and prepare gauze, and when ready let go of vessels, push the sterile gauze firmly into the wound, and bandage. Apply the pad of a bandage compress over the seat of the injury, passing the ends around the chest and back and tying securely under the opposite arm. Then place the center of a medium-wide cravat bandage over the pad, carry the ends across the chest and back, and tie under the arm on the opposite side.

DRESSING FOR AMPUTATED ARM

Control hemorrhage by digital pressure until a tourniquet is applied. Dress end of stump with sterile gauze or gauze procured from a sterile bandage compress, as described on page 44.

FIGURE 33.—Dressing for wound of armpit: *A*, Dressing without triangular sling; *B*, complete.

Hold the dressing in place with a triangular bandage, as follows: Make a fold along the base of triangular bandage; placing the stump in the center of the triangular bandage, carry the apex over the stump and up on the front surface of the arm; pass the ends of the triangular bandage around the arm and tie in front, fold the apex over the knot, and tuck it under. A similar dressing may be applied for a stump of the forearm, wrist, or hand.

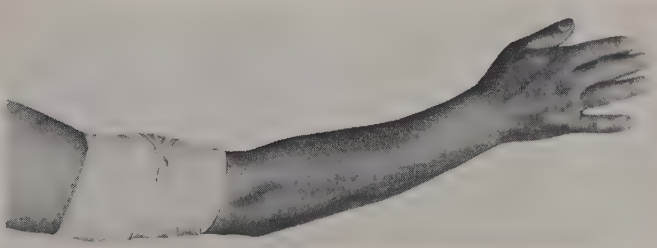

FIGURE 34.—Dressing for wound of arm.

WOUND AND BLEEDING OF ARM

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the arm, and tie them over the pad. Then place the center of a cravat bandage of suitable width over the pad; pass the ends around the arm, cross them, continue around the arm, and tie over the pad. (See fig. 34.) Control arterial bleeding of the arm by temporary pressure of the fingers or thumb over the artery at a pressure point above the wound and apply a tourniquet at nearest practicable pres-

sure point. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF ELBOW

Apply the pad of a sterile bandage compress over the wound, pass the ends around the elbow, cross them, carry them around the arm just above the elbow, cross them, carry them around the forearm just below the elbow, cross them, and tie on the outer side of the forearm. Cover with a cravat bandage of the desired width, as follows: Place the center over the point of the elbow, pass ends around and cross them at the bend of the elbow, crossing them again above the point of the elbow, carrying them around the arm, crossing again at the bend of elbow, carrying around forearm, and tying at the outer side below the point of the elbow. (See fig. 35.) The dressing should not be applied too tightly. Control arterial bleeding of the elbow by temporary pressure, then apply a tourniquet as for arterial bleeding of the arm. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF FOREARM

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the forearm, and tie them over the pad. Then place the center of a cravat bandage of suitable width over the pad, pass the ends around the forearm, cross them on the opposite side of the forearm, continue around the forearm, and tie over the pad. (See fig. 36.) Control arterial bleeding of the forearm by temporary pressure, then apply a tourniquet as for arterial bleeding of the arm. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF WRIST

For wound and bleeding of the wrist, dress as described above for wound and bleeding of the forearm. (See fig. 36.) Place the forearm and hand in a triangular bandage sling.

FIGURE 35.—Dressing for wound of elbow.

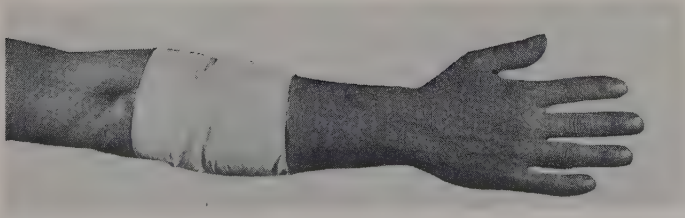

FIGURE 36.—Dressing for wound of forearm.

WOUND AND BLEEDING OF PALM OF HAND

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the hand and wrist, and tie them over the pad. Place the center of a cravat bandage over the pad, cross the ends at the back of the hand, bring one end around the little-finger side of the hand, bring the other end between the thumb and forefinger, carry the ends across the palm of the hand, cross them well back on the palm, continue around to the back of the hand or wrist, cross them, and pass them around the wrist. Complete the dressing by tying the ends on the back of the wrist. (See fig. 37.)

Control arterial bleeding of the palm of the hand by digital pressure at a convenient pressure point. Then apply a tourniquet as for arterial bleeding of the arm. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF BACK OF HAND

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the hand and wrist, and tie over the pad. Place the center of a cravat bandage over the pad, cross the ends at the palm of the hand, bring one end around the little-finger side of the hand, bring the other end between the thumb and forefinger, carry the ends across the back of the hand, crossing well back, and continue around the wrist one or more times and tie at the back of the wrist. (See fig. 38.)

Control arterial bleeding if present as described in dressing for wound and bleeding of palm of hand.

Place the forearm and hand in a triangular bandage sling.

EXTENSIVE WOUNDS AND BLEEDING OF HAND

This dressing should be used for wounds involving hand and fingers or multiple wounds of fingers.

FIGURE 37.—Dressing for wound of palm of hand.

FIGURE 38.—Dressing for wound of back of hand.

Apply sterile gauze or a large sterile bandage compress over wound. If a bandage compress is used, pass the ends several times around the hand and wrist, and tie them over the pad. Cover with a triangular bandage, as follows: Place the base on the inner side of the wrist, bringing the apex down over the palm of the hand and returning it around the tips of the fingers and over the back of the hand to a point above the wrist. Cross the ends, one on either side of the wrist, bring them to the forearm just above the wrist, and tie them on the back of the wrist. Bring the apex down over the knot and tuck it under. (See fig. 39.)

Control arterial bleeding for extensive wounds of the hand as for arterial bleeding of the palm of the hand. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF FINGER

Apply the pad of a small sterile bandage compress over the wound, pass the ends several times around the finger, and tie them over the pad; or use a small adhesive compress for the finger. Remove the cover from the adhesive by pulling from the center. Place the sterilized pad over the wound, pass an end of the adhesive around the finger and press it down smooth; then bring the other end around the other side of the finger, drawing the compress so that it is snug, and press it down. If the injuries are slight, apply a small bandage compress or adhesive compress to each finger as directed above. If the injuries are extensive or severe, dress as for extensive wounds of the hand. (See fig. 39.)

Control arterial bleeding as described for wounds and bleeding of hand. Apply a triangular bandage sling if necessary.

WOUND OF END OF FINGER

Apply the pad of a small sterile bandage compress over the wound so that the tails hang down on the front and back of the finger. Hold the tails securely in place about the middle

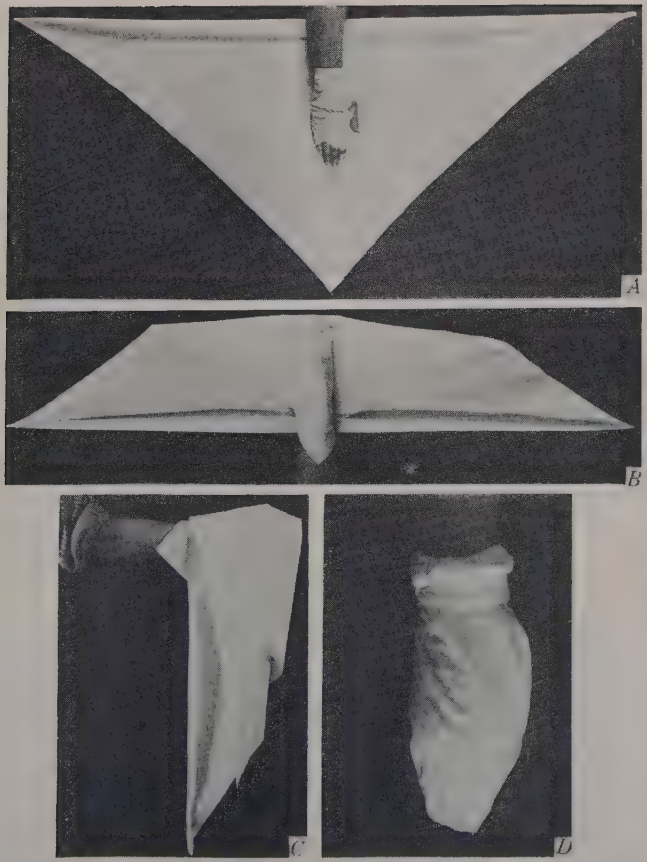

FIGURE 39.—Dressing for extensive wounds of hand: *A*, Compress applied, hand resting on triangular bandage; *B*, apex carried over ends of fingers and back of hand to wrist; *C*, one end folded over; *D*, dressing complete.

of the second bone of the finger. Make one circular turn with one of the tails above that point to anchor the bandage. Carry this tail to the end of the finger, and by a circular turn bind in the edges of the compress; then carry the tail by spiral turns to the starting point. Omitting the first circular turning, apply the other tail in a similar manner, with spiral turns in the opposite direction, and tie the ends on the back of the finger. (See fig. 40.)

When the ends of more than one finger are injured, apply a small sterile bandage compress to each finger as directed above, then cover as for extensive wounds of the hand. (See fig. 39.) Apply a triangular bandage sling, if necessary.

WOUND AND BLEEDING OF BACK BETWEEN SHOULDERS

Apply the pad of a sterile bandage compress over the wound, and tie the ends to hold the compress firmly in place. When possible, place the pad of the compress over the wound, taking the ends diagonally across the back, one end over the shoulder under the armpit across the back to the pad, the other end across the back under the opposite armpit over the shoulder across the back to the pad; tie the ends over the compress. Cover the compress and shoulders with a triangular bandage, as follows: Place the center of the base back of the neck, allowing the apex to drop down between the shoulders; carry the ends over the shoulders and under the armpits and around the back, and tie a knot over the apex; turn the apex up and tuck it over the knot. (See fig. 41.)

WOUND AND BLEEDING OF CHEST BETWEEN SHOULDERS

Apply the pad of a sterile bandage compress over the wound, and tie the ends to hold compress firmly in place. When possible, place the pad of the compress over the wound, taking the

FIGURE 40.—Dressing for wound of finger. Compress over end of finger and dressing complete.

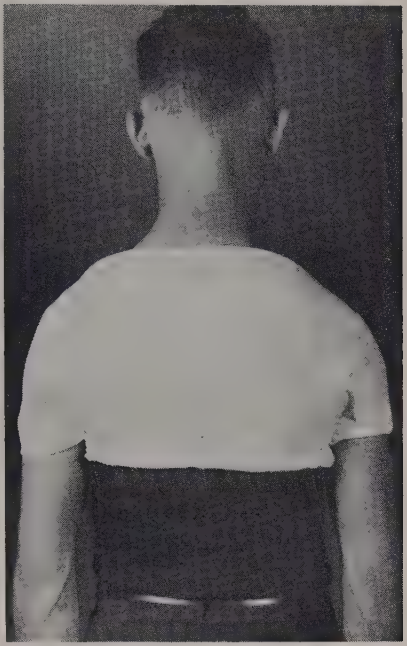

FIGURE 41.—Dressing for wound of back between shoulders.

FIGURE 42.—Dressing for wound of chest between shoulders.

ends diagonally across the chest, one end over one shoulder around under the armpit back to the pad, the other end under the opposite armpit around over the shoulder back to the pad; tie both ends over the compress pad. Cover the compress and chest with a triangular bandage, as follows: Place the center of the base at the lower part of the neck, allowing the apex to drop down over the abdomen, carry the ends over the shoulders around under the armpits to the center of the chest, and tie with the apex below the knot; then turn up the apex, and tuck it over the knot. (See fig. 42.)

WOUND AND BLEEDING OF BACK, CHEST, ABDOMEN, OR SIDE

Apply the pad of a sterile bandage compress over the wound, and take the ends around the body, one end across the back and the other across the chest; tie on the side. Cover with a medium cravat bandage by placing the center of the bandage on the side nearest to the injury, taking the ends across the back and chest, and tying on the opposite side. (See fig. 43, *A* and *B*.)

WOUND AND BLEEDING OF LOWER PART OF ABDOMEN, LOWER PART OF BACK, OR BUTTOCKS

For wound and bleeding of the lower part of the abdomen, the lower part of the back, or the buttocks, apply the pad of a sterile bandage compress over the wound, holding it in place by passing the ends around the body and tying them. Cover the compress with two triangular bandages. Tie the apexes of two triangular bandages together. Place the apexes in the crotch, bring the base of one bandage up on the abdomen, pass ends around to the back, and tie. Bring the base of the other bandage up on the back, pass the ends around to the abdomen, and tie. (See fig. 44, p. 126.)

FIGURE 43.—*A*, Dressing for wound of back, chest, or abdomen, using a wide cravat bandage; *B*, dressing for wound of side, using a wide cravat bandage.

WOUND AND BLEEDING OF GROIN

Apply the pad of a sterile bandage compress over the wound, carry the ends to the hip, cross them, carry across to the opposite side of the body, and tie them. To cover the compress use two cravat bandages tied together to make them long enough. Place the center of one of the cravat bandages over the pad, and follow the compress in such a manner as to cover it entirely. Continuing with the cravat bandages, pass them around the entire body the second time, and tie. (See fig. 45.)

WOUND AND BLEEDING OF CROTCH

Apply the pad of a sterile bandage compress or sterile gauze to the wound. Pass a cravat bandage around the body, and tie in front. Place the center of a wide cravat bandage over the knot of the first bandage. (See fig. 46, *A*.) Pass the two ends of the wide cravat bandage between the thighs, bring one end around each hip, and tie to the ends of the cravat bandage tied around the body. (See fig. 46, *B*.)

WOUND AND BLEEDING OF HIP

Place the pad of a sterile bandage compress over the wound and tie it in place. Cover it with a triangular bandage, as follows: Place the base well up on the thigh, with the apex pointing toward the armpit, bring the ends around the thigh, and tie. Pass a cravat bandage around the body and tie a knot over the apex, tying the apex in the knot, as described for wound and bleeding of shoulder. (See fig. 47.)

768735 O—48——10

FIGURE 44.—Dressing for wounds of lower part of abdomen, lower part of back, or buttocks, using spliced triangular bandages.

FIGURE 45.—Dressing for wound of groin.

FIGURE 46.—Dressing for wound of crotch: *A*, Partly applied; *B*, completed.

FIGURE 47.—Dressing for wound of hip.

FIGURE 48.—Dressing for wound of thigh.

WOUND AND BLEEDING OF THIGH

Apply the pad of a sterile bandage compress over the wound, pass the ends around the thigh, and tie over the pad. Cover with a wide cravat bandage by placing the center over the compress, pass the ends around the thigh, cross them, bring around again, and tie over the pad. (See fig. 48.)

Control arterial bleeding of the thigh by temporary pressure at a pressure point above the wound and apply a tourniquet.

FIGURE 49.—Dressing for wound of knee.

DRESSING FOR AMPUTATED THIGH OR LEG

Control hemorrhage by digital pressure until a tourniquet is applied. Dress end of stump with sterile gauze or gauze procured from a sterile bandage compress as described on page 44. Hold the dressing in place with a triangular bandage, as follows: Make a fold along the base of the triangular bandage, placing the stump in the center of the bandage: carry the apex

over the stump up on to the front surface of the thigh, pass the ends of the triangular bandage around the thigh, and tie in front; then fold the apex over the knot and tuck it under. A similar dressing may be applied for stump of leg or foot.

WOUND AND BLEEDING OF KNEE

Apply the pad of a sterile bandage compress over the wound, and tie it firmly in place. Place the center of a medium cravat bandage over the pad. Bring the ends of the bandage around either side of the leg, cross them at the back of the knee, pull them forward, and tie them above the knee. (See fig. 49.) Control arterial bleeding of the knee by temporary pressure, and apply a tourniquet as directed for arterial bleeding of the thigh.

WOUND AND BLEEDING OF LEG

Apply the pad of a sterile bandage compress over the wound, pass the ends around the leg, and tie over the pad. Place the center of a wide cravat bandage over the pad, pass the ends around the leg, cross on the opposite side of the leg, bring around again, and tie. (See fig. 50.) Control arterial bleeding of the leg by temporary pressure. Then apply a tourniquet, as for arterial bleeding of the thigh.

BLEEDING FROM VARICOSE VEINS IN LEG

Varicose veins are enlarged veins, usually in the leg. Exertion may cause them to burst, and serious results may follow. Lay the person down and elevate the leg. Rip or cut tight clothing or constrictions from around the leg, so that the injury may be seen. Apply the pad of a sterile bandage compress over the bleeding point, and bandage it firmly into place. Cover with a cravat bandage, as for wound and bleeding of the leg. (See fig. 50.)

FIGURE 50.—Dressing for wound of leg.

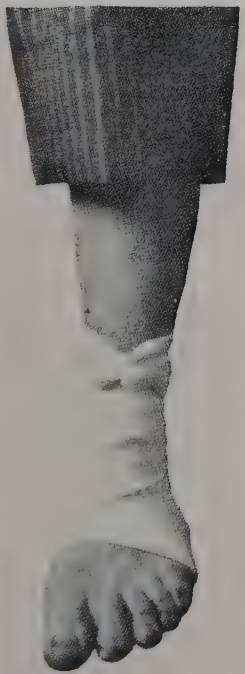

FIGURE 51.—Dressing for wound of ankle or foot.

FIGURE 52.—Dressing for extensive wounds of foot.

WOUND AND BLEEDING OF ANKLE OR FOOT

Apply the pad of a sterile bandage compress to the wound, and carry the ends around the ankle and foot or the foot and ankle and tie over pad. Place the center of a cravat bandage over the compress, and carry the ends around the ankle and foot or foot and ankle, ending in a tie as near the front of the ankle as possible. (See fig. 51.) Control arterial bleeding of the foot by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh.

EXTENSIVE WOUNDS AND BLEEDING OF FOOT

Apply sterile gauze or the pad of a large sterile bandage compress over the wound, and tie it in place. Cover with an open triangular bandage in the following manner: Place the base of the triangle on the back of the ankle, and bring the apex under the sole of the foot, over the toes, back over the instep, and up the leg to a point above ankle in front; then pass the ends, crossing them over the instep, around the ankle, and tie. Fold the apex around the knot. (See fig. 52.) Control arterial bleeding of the foot by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh.

WOUND AND BLEEDING OF TOE

Apply the pad of a small sterile bandage compress over the wound, pass the ends around the toe several times, and tie them over the pad; or use a small adhesive compress. Remove the cover from the adhesive, place the pad around the toe, and press one end down smoothly; then bring the other end around the other side of the toe, drawing the compress so that it is snug. If more than one toe is injured, apply a small bandage compress or adhesive compress to each toe as directed above. Then apply a triangular bandage as described for extensive

wounds and bleeding of foot. Control arterial bleeding of the toe by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh.

WOUND OF END OF TOE

Apply the pad of a small sterile bandage compress over the wound, as for wound of end of finger. (See fig. 40, p. 121.) When more than one toe is severely injured, apply a small bandage compress to each toe as directed above, then apply an open triangular bandage as described for extensive wounds of the foot. (See fig. 52.)

BURNS OR SCALDS

Burns and scalds are injuries caused by dry heat, fire, or heated objects, electricity, friction, hot solutions, steam and vapors, and chemicals, such as a strong acid or a strong alkali. Burns more commonly are the result of contact with dry heat, electricity, friction, and chemicals, whereas scalds more commonly are the result of contact with hot solutions, hot vapors, or steam. Electricity may cause burns either by current passing through the body or by electric flashes.

Depending on its intensity and the duration of its contact with the body, the resulting injury by an agent causing a burn or scald is classified by degrees.

Where the contact is brief or the agency is mild and the outer surface of the skin is only scorched, causing reddening and slight swelling, the injury is known as a first-degree burn or scald.

Where the contact is longer or the agent is more severe, and the under layer of the skin is involved, causing in addition to reddening and swelling the formation of blisters, the injury is known as a second-degree burn or scald.

Where the outer skin is destroyed and the tissues beneath the skin are damaged, the injury is known as a third-degree burn or scald.

The seriousness of a burn or scald is influenced by the extent of the body surface involved as well as by the depth to which the tissues are penetrated. It is generally assumed that where one-third of the surface of the body is injured by a second-degree burn or scald, death usually follows, but even a much smaller area injured by a third-degree burn often endangers life.

Shock is always present in severe burns and scalds; and, due to circulatory disturbances and the formation of toxins, patients suffering from such injuries should receive medical attention as early as possible.

TREATMENT FOR BURNS AND SCALDS

The emergency or first-aid care of burns or scalds has for its objects the exclusion of air from the burned or scalded area, the relief of pain, and the prevention of infection.

Remove all clothing from the injured area, but any that adheres to the skin should be cut around and left in place. Keep the patient covered, except the injured part, as there is a tendency to chilling. As soon as the burned or scalded area has been exposed, it should be covered by a protective dressing and a loosely applied cover bandage. Modern medical treatment for burns and scalds employs water-soluble drugs, and the use of grease or oils in their first-aid care makes necessary the cleansing of the burned or scalded surfaces with a solvent before medical treatment can be started. This delays the medical treatment and is very painful. Therefore, first-aid dressings for burns or scalds should be free from grease or oil.

Picric-acid gauze is one of the most popular burn dressings. Its use does not interfere with any subsequent burn treatment. It consists of sterile gauze, impregnated with a ½- to 1-percent solution of picric acid, dried, and folded to fit into convenient

sealed packages. It does not deteriorate and is easy to apply. When used, the gauze is removed from the package, carefully unfolded so as not to contaminate the part to be applied to the burned surface, moistened with clean water, placed over the injured area, and held in place by a loosely applied bandage. To keep the gauze from drying, the cover bandage may also be kept moist. Several packages of picric-acid gauze can be used to cover a considerable area. Picric-acid burn ointments made with a water-soluble base also may be had. For small burns, adhesive compresses employing picric-acid gauze are now available.

Tannic acid is another popular dressing for burns. As tannic acid exposed to air oxidizes rapidly and loses its effectiveness as a burn dressing, no tannic-acid gauze has as yet been perfected. Ointments of tannic acid in water-soluble bases, plain or containing added antiseptics, are used extensively in first aid. Burn packets containing dry tannic acid with or without added antiseptics, sealed in air-tight ampoules, together with a container for making a 5- to 10-percent tannic-acid solution by the addition of measured quantities of clean water, are available. Gauze is either soaked in the solution and applied to the injury or the solution may be sprayed over the area and covered by sterile gauze moistened with the solution.

Certain precautions should be exercised in dressing burns and scalds. Burned and scalded surfaces are subject to infection the same as open wounds and require the same care to prevent infection. Blisters should not be broken intentionally. Adjacent burned surfaces should never be permitted to be in contact, such as areas between the fingers or toes, the ears and the side of the head, the undersurface of the arm and the chest wall, the folds of the groin, and similar places. Always see that burn dressings separate these surfaces. When picric-acid and tannic-acid ointments are used, the entire area must be covered by sterile gauze before the cover bandage is applied. If a wound should be present in the burned area, cover it with the

burn dressing. Cover bandages should be loose enough to prevent pressure on burned surfaces. As swelling often takes place after burn dressings have been applied, checks should be made frequently to see that they are not too tight. Watch for evidence of shock and treat it if present. Permit the patient to have all the water he will drink, but give it in moderate amounts at frequent intervals.

CHEMICAL BURNS

Where a person has been burned by a chemical, the area should be washed thoroughly with clean water to dilute the chemical and then dressed as for a burn. A continuous stream of cool water should be kept flowing over the burned area from a spigot or some container long enough to dilute the chemical. After 5 or more minutes of washing the burn dressing can be applied. Weak acid solutions can be used to neutralize alkali burns, or weak alkali solutions can be used to neutralize acid burns if the nature of the agency causing the burns is positively known. However, neutralizing solutions should be used only by direction of a physician.

BURNS OF EYE BY CHEMICALS

Frequently chemical substances get into the eye, especially lime, cement, caustic soda, or acids or alkalies from storage batteries. The treatment is to wash the eye freely with cold water. To do this the patient should be lying down, the eyelids held open by the fingers and the water poured into the inner corner of the eye from a pitcher or other container. Use plenty of water and wash the eye thoroughly, being sure the water actually flows across the eye. No neutralizing solution should be placed in the eye. After the eye has been washed, apply dressing for injury of the eye. (See fig. 28, p. 106.) Chemical burns of the eye should receive the attention of an eye specialist as early as possible.

BURNS OF FACE, HEAD, OR NECK

Apply picric-acid gauze or other burn dressing, making sure the gauze is placed between raw surfaces of ears and head, and cover this with two triangular bandages and one cravat bandage, as follows: Place the base of a triangular bandage over the top of the head a little back of the center, the apex dropping over the face and under the chin. Cross the two ends back of the head below the bony prominence; pass them around the neck and tie loosely over the apex under the chin. Place the center of the second triangular bandage over the top of the head, but somewhat in front of the center, the apex passing back over the head to the back of the neck. Carry the two ends under the chin, cross them, pass them around the neck, and tie loosely at the back over the apex. Place the center of a cravat bandage under the chin, pass the bandage around the neck, crossing at the back of the neck, and tie in front. (See fig. 53.) If dressings also are to be applied to the chest and back, leave the apex of the head and face bandages extending down the chest and back, placing them under the chest and back dressings. If the head and face only are burned, fold the apexes up and place under bandage applied around neck. Cut a hole in the first triangular bandage over the patient's nose large enough for him to breathe freely. If the neck only is burned, it may be dressed by applying picric-acid gauze or other burn dressing and covering with a cravat bandage as for wound and bleeding of neck. (See fig. 31, p. 108.)

BURNS OF SHOULDER

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing and cover with a triangular bandage, as described for wound and bleeding of shoulder. (See fig. 32, p. 110.) If triangular bandages are applied for burns of the back or chest, the shoulders are covered by these bandages, and no separate shoulder dressing is required.

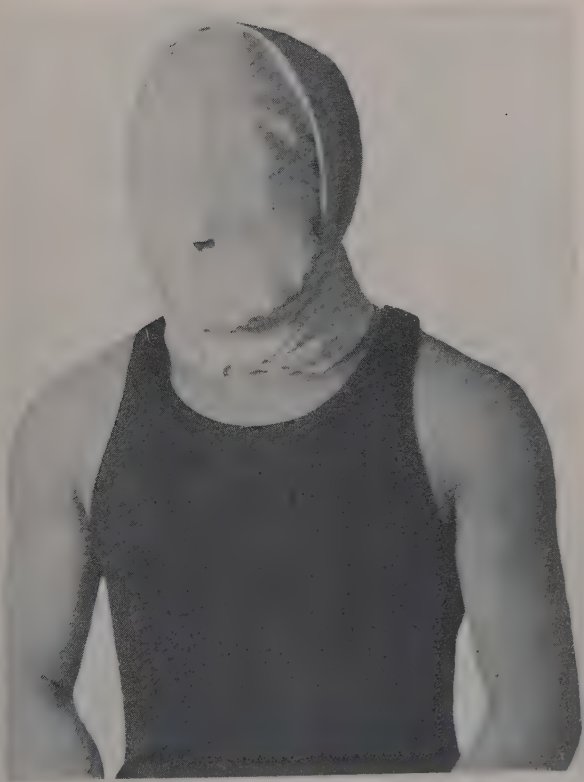

FIGURE 53.—Dressing for burns of face, head, and neck.

BURNS OF ARM

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing and cover with an extra-wide cravat bandage. (See fig. 9, *B*, p. 41.) Place the center of the bandage on the arm, take the ends around the arm several times, and tie on the outside. (See fig. 54.)

BURNS OF FOREARM

Remove clothing from burned surfaces, apply picric-acid gauze or other burn dressing, and dress as for burns of the arm. (See fig. 55.)

BURNS OF HAND

Place picric-acid gauze or other burn dressing over burned surfaces, prevent raw surfaces of the fingers from touching each other by placing gauze between them, then apply a triangular bandage as for extensive wounds and bleeding of the hand. (See fig. 39, p. 119.)

BURNS OF BACK

Remove clothing from burned surfaces and apply picric-acid gauze or other burn dressing. Cover this with a triangular bandage, the base of which is placed diagonally across the back, one end passing over the corresponding shoulder. Bring the lower end and the apex together in front of the body and tie. Tie the end passing over the shoulder in the same place. (See fig. 56.) Complete the dressing by applying another triangular bandage on the other side of the back in a like manner. (See fig. 56.) If the bandages are too short to tie loosely, splice them with part of another bandage or string. Small burns of the back may be dressed with a triangular or a wide cravat bandage as for wound and bleeding between shoulders (see fig. 41, p. 121), or wound of the back (see fig. 43, p. 124), as the injury may indicate.

FIGURE 54.—Dressing for burns of arm.

768735 O—48——11

FIGURE 55.—Dressing for burns of forearm.

FIGURE 56.—Dressing for burns of back and shoulders.

BURNS OF CHEST

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and dress by applying triangular bandages on the chest in the same manner as described for burns of the back. (See fig. 57.) Small burns of the chest may be dressed with a wide cravat bandage, as for wound and bleeding of the chest. (See fig. 43, p. 124.)

BURNS OF LOWER ABDOMEN, LOWER BACK, AND BUTTOCKS

To dress burns of the lower abdomen, remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with triangular bandages as described for wound and bleeding of lower part of abdomen, lower part of back, or buttocks. (See fig. 44, p. 126.)

To dress burns of the lower back and buttocks, remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with triangular bandages as described for wound and bleeding of lower part of abdomen, lower part of back, or buttocks. (See fig. 44, p. 126.)

When both the lower abdomen and lower back are burned, remove all clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover as above.

BURNS OF HIP

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with a triangular bandage as described for wound and bleeding of hip. (See fig. 47, p. 128.)

BURNS OF THIGH

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover as described for burns of the arm. (See fig. 54, p. 141.)

FIGURE 57.—Dressing for burns of chest and shoulders.

BURNS OF LEG

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing. and cover as described for burns of the forearm. (See fig. 55, p. 142.)

BURNS OF FOOT

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, making sure gauze is placed between raw surfaces of toes, and cover as described for extensive wounds of foot. (See fig. 52, p. 132.)

COMPOSITE BURNS OF HEAD, FACE, NECK, BODY, AND EXTREMITIES

To dress any or all of the above, remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover the part or parts as described under the different headings. (See fig. 58.)

In treating all burns, remove loose clothing before applying dressings, but do not try to remove clothing that adheres to the skin—*cut around it*. Also, be sure to place gauze between open or raw surfaces when dressing fingers, toes, ears, etc. Watch for and treat physical shock if it is present.

CLOSED WOUNDS

Several types of injuries may be suffered where the skin is not broken but damage occurs to the deeper tissues; these injuries usually are classed as closed wounds.

BRUISES

Bruises are the most frequent injuries suffered. They are caused by some blunt instrument or object striking the body or

FIGURE 58.—Dressing for burns of head, face, neck, body, and extremities.

by the body coming in contact with a hard object, as in a fall or a bump. Usually the skin is not broken but the soft tissues beneath the skin are injured. Small blood vessels are ruptured, causing blood to seep into the surrounding tissues, which produces swelling, at first red but later turning darker to a blue or purple discoloration. If a larger blood vessel is broken, much blood gathers under the skin, causing greater swelling and discoloration.

The symptoms of bruises are immediate pain from injury to the nerves, swelling, rapid discoloration, and later pain on pressure or movement. A bruise may be only the external evidence of a more serious injury to deep-lying structures.

TREATMENT

The treatment should be to limit swelling and to decrease pain. Apply cold applications, such as an ice bag or towel wrung out in cold water. Elevate the injured part, and place at complete rest. Make sure there is no other injury, such as a broken bone or dislocation. Severe bruises should have the care of a physician.

STRAINS

A strain is the overstretching of a muscle or a tendon of a muscle. In severe strains the fibers forming the muscle or tendon may be torn. Strains are caused by sudden movements or by violent exertion in lifting or moving heavy weights.

The symptoms of strains are a sharp pain or cramp immediately, and any attempt to use the muscle is difficult and painful. Moderate swelling may be present.

TREATMENT

Place patient in a comfortable position, and apply hot applications. In treating most strains dry heat is more effective than moist heat. Rub the part with warm alcohol or witch hazel to relieve pain. Massage stimulates circulation and prevents further venous congestion. Keep the part at rest.

The most frequent strain is that of the muscles of the back, caused by improper lifting or the attempt to lift too heavy objects. To prevent back strains when lifting and moving heavy weights, the strong muscles of the legs and arms should be used instead of the muscles of the back. When lifting an object from the ground, instead of stooping over by bending the back and waist, bend the knees but keep the feet as close together as possible. See that the body weight is evenly distributed on each foot, and keep the back straight. Rise by straightening the legs, thus making the fullest use of the leg and arm muscles and taking most of the strain from the back and abdominal muscles. *Do not attempt to raise or move weights that are too heavy; get assistance.*

SPRAINS

Sprains are injuries due to the stretching or tearing of the ligaments or other tissues around a joint. They are caused by a sudden twist or wrench. Sprains range from minor injuries causing pain or discomfort for only a few hours to severe cases where the tearing of the tissues requires many weeks of medical care before normal use of the joint is restored.

The symptoms of sprains are pain around the joint and inability to use it. Swelling is usually rapid and marked, followed by discoloration.

TREATMENT

Place the joint at absolute rest in an elevated position. Cold applications can be used to limit swelling if treatment is prompt, followed by hot applications to relieve pain. The joint may be bound firmly with a cravat bandage. Never attempt to strap a sprained joint with adhesive tape. The use of adhesive tape in caring for a sprained joint is beyond first aid and should be left to the physician if he deems it advisable.

Due to the great amount of swelling in some sprains, it is often difficult to determine whether the joint has been dislocated or if a fracture has occurred in or near the joint. Such cases

should receive medical attention, as they often require X-ray examination to determine the extent of the injury. If in doubt as to the extent of the injury, play safe and treat it as a fracture.

When an ankle has been sprained and it is necessary for the injured person to use the foot temporarily to reach a place for further care, the following dressing is beneficial.

DRESSING FOR A SPRAINED ANKLE

Unlace but do not remove the shoe. Place the center of a narrow cravat bandage under the foot in front of the heel of the shoe. Carry the ends up around the back of the ankle, cross and bring to the front of the foot, and cross above the arch. Carry one end through the stirrup formed by the bandage from under the foot to above the heel and do likewise with the other end. Pull the ends as tight as possible, cross over the arch, and tie at the back of the ankle. (See fig. 59.)

RUPTURE OR HERNIA

A rupture or hernia is the protrusion of a portion of an internal organ, usually the bowel, through the muscular wall of the abdomen. Most ruptures occur in or just above the groin, although ruptures may occur at other places over the abdomen. Ruptures are caused by muscular strains from lifting or pushing, violent coughing, sudden jars in jumping, and similar acts.

The symptoms of a rupture are a sharp, stinging pain and the feeling of something giving way at the location of the rupture. On examination swelling is found ranging in size from that of a marble to that of the doubled-up fist, or even larger. The swelling is usually tender. Nausea and vomiting often occur.

FIGURE 59.—Dressing for a sprained ankle.

TREATMENT

Lay the patient on his back with knees well drawn up, supported by a large pad. Two triangular bandages tied together may be passed around the thighs and ankles to hold the legs in position. (See fig. 60.) In this position the protrusion may slip back through the muscles into the abdominal cavity. If the swelling remains apply ice or cold applications, and procure medical assistance. Gentleness is necessary in handling the protrusion. Never attempt to reduce the swelling, as serious damage may be caused to the bowel or its covering. If the patient has to be moved, transport him lying on his back with

FIGURE 60.—Dressing for rupture.

the knees drawn up and supported with plenty of padding. All cases of rupture should have medical attention. For proper method of lifting to prevent ruptures, see page 149.)

FOREIGN BODIES IN EYE

Foreign bodies, such as particles of dirt, sand, cinders, coal, emery dust, or fine pieces of metal, frequently are blown or driven into the eye and lodge there. They not only cause a feeling of discomfort but, if not removed, set up inflammation that may lead to infection. Fortunately, through an increased flow of tears, nature dislodges many of these substances before any harm is done. In no case should the eye be rubbed, as rubbing may cause scratches of the delicate eye tissues or may force any foreign particle with sharp edges into the tissues, making its removal difficult.

The tissues of the eye are very delicate and can be damaged seriously by rough or improper methods of attempting to remove foreign bodies. It is always safer to send the patient to a physician who has the necessary training and equipment to care for such cases than for a first-aid man to attempt to remove foreign objects.

Sometimes a foreign body lodged under the upper lid may be removed by drawing the upper lid down over the lower lid; as the upper lid returns to its normal position, its under surface will be drawn over the lashes of the lower lid and the foreign body removed by the wiping action.

Another method is to expose the under surface by grasping the eyelashes between the thumb and forefinger of one hand and turning the lid up over the tip of the finger or over a match or pencil; the particle may then be removed carefully with a corner of a piece of folded sterile gauze.

Particles lodged under the lower lid may be removed if the lower lid is pulled down, exposing the inner surface.

Should a foreign body become lodged on the eyeball, do not attempt to disturb it, as it may be forced into the eye and cause a serious condition. Place a bandage compress over the eye (see fig. 28, p. 106), and send the person to a doctor at once. Removal of particles embedded in the eyeball requires skill, and the abrasion caused thereby should have medical care to prevent infection.

Gentleness in handling eye injuries is absolutely essential. Never use the point of a knife blade, a toothpick, or a sharpened matchstick to try to dislodge a foreign body in the eye. If difficulty is experienced in removing a foreign body from the eye, send the patient to a doctor at once. Wearing proper goggles not only prevents wounds of the eyes but keeps foreign particles from entering them. (See Burns of Eyes, p. 137.)

FOREIGN BODIES IN EAR

Small insects or pieces of coal or other material may gain access to the ear. Other objects, such as kernels of corn, peas, buttons, or seeds, are sometimes placed in the ears by children. Such substances as seeds absorb moisture and swell in the ear, making dislodgment difficult, and often cause painful inflammation.

Pins, hairpins, or pieces of wire should never be inserted in the ear to dislodge foreign bodies, as they may damage the tissues lining the ear or pierce the ear drum. Insects entering the ear may be killed by turning the ear up and dropping sweet oil, olive oil, or mineral oil warmed to body temperature into it. After the oil has been in the ear several minutes, turn the head so the ear is down, and the suffocated insect usually will float out with the oil as it runs from the ear.

Foreign bodies that cannot be removed readily from the ear should receive medical attention.

FOREIGN BODIES IN NOSE

Foreign bodies in the nose usually can be removed without difficulty, but occasionally they require the services of a physician. Sneezing induced by snuff or pepper or tickling the opposite nostril with a feather usually will dislodge foreign bodies from the nose. Hard blowing of the nose with the unobstructed nostril held closed often removes the foreign body. Should these means fail, medical attention should be obtained.

FOREIGN BODIES IN THE THROAT OR WINDPIPE

Pins, coins, fishbones, false teeth, and particles of food often become lodged in the throat or windpipe. Although as a rule there is not complete obstruction of the air passages, more or less severe symptoms of suffocation are present. The victim's face becomes livid, and he gasps for breath, with violent fits of coughing. Particles of food frequently are sucked into the windpipe by sudden inspiration while eating. A person should be careful not to laugh while he has anything in his mouth.

In all cases an attempt should be made at once to remove the obstruction. Have the patient open his mouth wide, facing the light. Hold the tongue down, and look into the throat. Often the object can be seen. Pass the forefinger into the throat alongside of the tongue, and try to withdraw the object. Care should be taken not to push the object farther into the throat or windpipe.

Foreign bodies that are down so deep they cannot be seen or felt with the finger may be dislodged by coughing or by slapping the person on the back between the shoulder blades. If this fails, lay the person in an inverted position with head very low, and slap him sharply between the shoulder blades with the hope of dislodging the substance, aided by gravity. Young children may be held up by the legs with the head down

and slapped as above to dislodge foreign bodies from the throat or windpipe.

If foreign bodies cannot be removed by the above methods, send for a physician at once. Meanwhile, if there is serious interference with breathing, perform artificial respiration.

FOREIGN BODIES IN STOMACH

Foreign bodies, such as pins, coins, nails, and other articles, sometimes are swallowed accidentally or, as in the case of small children or the insane, are swallowed deliberately. They may lodge in the gullet or tube leading to the stomach and cause difficulty in swallowing, but more often they pass directly into the stomach.

Do not attempt to dislodge them from either the gullet or the stomach. Do not give anything to cause vomiting or to move the bowels. Consult a physician immediately and leave the treatment to him.

DISLOCATIONS

Where two or more bones come together and there is no bony union between them, they form a joint. The several bones forming a joint are held in place by bands of strong fibrous tissues known as ligaments. There are three varieties of joints: Immovable joints, joints with limited motion, and freely movable joints. In first aid, we are more particularly concerned with the principal freely movable joints—the lower jaw, the shoulder, the elbow, the wrist, the fingers, the hip, the knee, the ankle, and the toes. These are the joints most commonly dislocated.

A dislocation is the slipping out of normal position of one or more bones forming a joint. The ligaments holding the bones in proper position are stretched and sometimes torn loose. Dislocations result from force applied at or near the joints,

from sudden muscular contractions, from twisting strains on joint ligaments, or from falls where the force of landing is transferred to a joint.

The general symptoms of dislocations are as follows:

Rigidity and loss of function.—The parts forming the joint are held stiff and cannot be moved.

Deformity.—The parts assume an unnatural shape, and when compared with the normal joint of the opposite side of the body they are misshapen. Dislocated extremities may be shorter or longer than normal.

Pain.—Pain usually is severe in the region of the joint.

Swelling.—Swelling usually is present about the joint.

In first aid no attempt should be made to reduce dislocations, except *dislocations of the lower jaw, fingers, and toes.* Where medical aid is readily available, even reduction of these dislocations should not be attempted. All other dislocations must be cared for by applying dressings and splints so that the parts are immobilized in the line of deformity in which they are found, and medical care obtained. As dislocations generally are held rigid, no support is necessary during dressing. Shock frequently is present in dislocations and should be treated.

The reduction of dislocations requires skill in manipulation of the parts so as not to damage further the joint ligaments and the numerous blood vessels and nerves found close to joints. Only a physician is trained well enough to reduce dislocations properly except those mentioned above.

DISLOCATION OF LOWER JAW

A dislocated jaw is painful. The mouth is open, the jaw is rigid and cannot be closed, and there is difficulty in talking. To reduce this dislocation first wrap both thumbs in several layers of cloth, so that they will not be liable to injury. Then

768735 O—48—12

place the thumbs in the injured person's mouth, resting them on his lower teeth well back on each side, while the fingers seize the lower jaw outside. Press first downward, then backward. As soon as the jaw starts into place the thumbs should be slipped off the teeth to the inside of the checks, so that they will not be caught between the teeth when the jaw springs into place. The center of a cravat bandage should be placed over the front of the chin and tied at the back of the head, the ends being left long. Have the patient open his mouth and place a bandage compress, lead pencil, or like object between the teeth to prevent the next bandage from being placed too tightly. Take another cravat bandage, placing its center under the patient's chin, and bring the ends to the center of the top of the head and tie, leaving the ends long. The ends of both cravats are brought together and tied separately. Now remove the wedging object from between the patient's teeth. If difficulty is experienced in reducing a dislocated jaw, do not make repeated attempts to reduce the dislocation. Apply no dressing but have the patient consult a doctor immediately. (See fig. 61.)

DISLOCATION OF SHOULDER

The shoulder joint is dislocated more frequently than any other joint in the body. This injury may be produced by falls or blows on the shoulder or by falls on the hand or elbow.

With this dislocation the arm is held rigid, the elbow stands off 1 or 2 inches from the body, the shoulder appears flat, and there is a marked depression beneath the point of the shoulder. In addition, there are pain and swelling at the seat of the injury. By placing the fingers in the armpit the head of the bone may be felt in an abnormal position compared to the uninjured side. The injured man will be unable to bring the

FIGURE 61.—Dressing for dislocation or fracture of lower jaw: *A*, Front view; *B*, back view.

elbow of the injured side in contact with the chest when the palm of the hand of the injured side is placed near the top of the opposite shoulder.

Place a pad about 4 inches wide and 3 inches thick beneath the arm, extending from the armpit to the elbow. Tie the pad in place with a medium cravat bandage, with several wraps around the pad and arm and a knot tied on the outside of the arm. Place the center of a narrow cravat bandage on the outside of the arm just above the elbow. Carry one end across the chest and the other end across the back, and tie on the opposite side of the chest over a pad. Place the arm in a triangular bandage sling. (See fig. 62, *A* and *B*.) Send the patient to a physician.

DISLOCATION OF ELBOW

Dislocation occurs at the elbow joint as a result of a direct force or blow at the joint, and also is caused occasionally by a fall on the hand. It usually can be recognized by deformity at the joint, great pain, and inability to bend the limb at the joint. Prepare a splint—straight, L-shaped, or a modification of latter, depending on the position of the limb—long enough to reach from 1 inch below the armpit to 1 inch beyond the tip of the middle finger. Pad to conform to the deformity, and place on the inside of the limb.

To dress with a straight splint, use four narrow cravat bandages. Place the center of the first cravat bandage on the arm at the upper end of the splint, pass the ends around the arm and splint one or more times, and tie on the outside. Place the center of the second cravat bandage on the arm just above the elbow, and apply in a similar manner. Place the center of the third cravat bandage on the arm just below the elbow, and apply in a similar manner. Place the center of the fourth cravat bandage on the outside of the wrist, pass around to splint crossing, and pass to the outside of the back of the

FIGURE 62.—Dressing for dislocation of shoulder: *A*, Dressing applied without triangular sling; *B*, complete.

hand. Pass one end between the thumb and forefinger and the other end around the little-finger side, cross them over the splint on the palm side of the hand, bring the ends around to the back of the hand, and tie. (See fig. 63.) Send the patient to a physician.

To dress with an L-shaped splint, have the upper part of the splint reach from 1 inch below the armpit to the point of the elbow and the other part reach from the point of the elbow to 1 inch beyond the middle finger. Join the two parts securely, forming the angle of deformity of the arm. Pad well to conform to the deformity of the arm. Apply a splint with four narrow cravat bandages, as described under straight splint. Place the forearm in a cravat-bandage sling. (See fig. 64.) Send the patient to a physician.

DISLOCATION OF WRIST

Dislocations at the wrist usually occur from falls where the hand is extended to break the force of the fall. There are several deformities that may be present, and one or more bones may be broken. There is marked deformity at the joint. Swelling often takes place rapidly, and the true condition can be determined only by X-ray. Place the forearm in a triangular bandage sling. (See fig. 12, *A*, p. 47.) Have the patient see a physician as soon as possible.

DISLOCATION OF FINGER

The usual symptoms of a dislocated finger are shortening, deformity at the joint, swelling, inability to bend the finger at the dislocation, and pain. To treat a dislocated finger, have the hand with the back upwards. Grasp the finger just above the dislocated joint with one hand and just below the joint with the other hand so the extension is made only at the dislocated joint. Pull straight away from the hand, and the bone usually

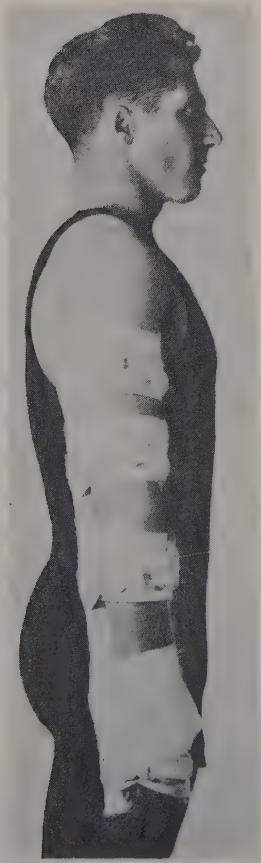

FIGURE 63.—Dressing for dislocation of elbow, using straight splint.

FIGURE 64.—Dressing for dislocation of elbow, using L-shaped splint

will slip into place. When traction is made on more than the injured joint, a secondary dislocation may occur. Do not attempt reduction of a dislocated finger if there is an open wound near the joint. Dress the wound, and send the patient to a physician.

DISLOCATION OF HIP

Dislocation of the hip usually is the result of falling from a height onto the foot or knee, or it may be caused by a direct blow when the thigh is at an angle with the spine. There are several varieties of dislocation, described according to the direction taken by the head of the thigh bone, but for all practical purposes they may be divided into forward and backward dislocations. A backward dislocation is by far the most common. In either type of dislocation the limb is held rigid, and the pain is marked. In a forward dislocation the thigh is somewhat flexed and held outward, the foot being also turned out. The limb may be lengthened or shortened. In a backward dislocation the foot is turned inward, and the thigh is drawn toward or across the opposite leg. Shortening of the limb is also marked.

Place the injured person on a board about 12 inches wide, 7 feet long, and about 1½ inches thick. If such a board is not available, a framework similar to that used in dressing a broken back (see p. 188) may be used. Before the patient is placed on the board or back splint it must be tested and found strong enough to bear the weight of the patient. Pad well with blankets, clothing, etc. Make a pad of clothing, blankets, or brattice cloth large enough to support the limb in the line of deformity. Place a small pad between the feet. Use six cravat bandages, as follows: Pass the first cravat bandage around the board and the upper part of the chest and tie the ends of the bandage on the injured side near the board. Pass the second cravat bandage around the board and lower part of the chest, and tie the ends of the bandage on the injured side near the board. Pass

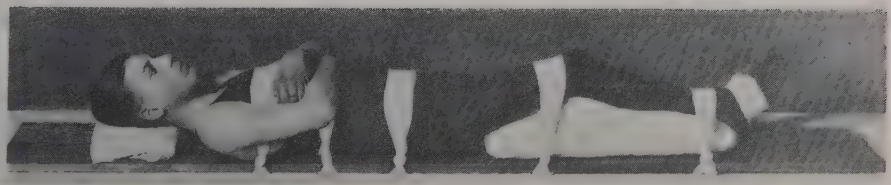

FIGURE 65.—Dressing for dislocation of hip.

the third cravat bandage around the board and the body at the hips, tying the ends as described above. Pass the fourth cravat bandage around the board and the thigh just above the knees, and tie it on the injured side near the board. Pass the fifth cravat bandage around the ankles and the board, and tie it near the board on the injured side. Place the center of the sixth cravat bandage over the insteps, cross the ends under the soles of the feet, and bring them back to the insteps, tying loosely. The board or back splint may be used as a stretcher for transportation. If the patient is unconscious, pass a cravat bandage around the head and the board and tie it. Also tie the forearms folded across the chest. Place an open triangular bandage across the chest with apex down, fold the arms over one another on the bandage, bring ends together, and tie. Bring the apex up and tie to knotted ends. (See fig. 66.) Send the patient to a physician.

DISLOCATION OF KNEE OR KNEECAP

Dislocation of the knee or the kneecap results from direct force applied at the knee or from a fall on the knee. There are signs of deformity, great pain, and inability to use the knee. Apply splint as for fracture of thigh, padding to conform to deformity. (See fig. 76, p. 192.) Send the patient to a physician.

DISLOCATION OF ANKLE

Dislocations of the ankle may show several types of deformity. Bones may or may not be broken. There is a marked deformity at the joint. As a rule, swelling is rapid and marked. Usually the extent of the injury can be determined only by X-ray. Apply a splint as for fracture of thigh, padding to conform to deformity. (See fig. 76, p. 192.) Send patient to a physician.

FIGURE 66.—Dressing for tying arms together of an unconscious patient for transportation.

DISLOCATION OF TOE

The usual symptoms of a dislocated toe are shortening, deformity at the joint, inability to bend the toe at the joint dislocated, and pain. Grasp the foot in one hand and the end of the dislocated toe in the other and pull directly away from the foot; the bone usually will slip into place. Only the dislocated joint should be between the first-aid man's hands. As in the case of the finger, when traction is made on more than the injured joint, a secondary dislocation may occur. Do not attempt to reduce the dislocation if there is an open wound near the joint. Dress the wound and send the patient to a physician.

FRACTURES

The framework on which the human body is built is made up of the bones forming the skeleton. The bones of the body are of various sizes and shapes. A broken bone is called a fracture. There are many types of fractures, but in first aid they are classified in two groups, simple and compound.

In simple fractures a bone is broken, but there is no wound extending from the ends of the bone out through the skin. Usually in simple fractures there is no considerable displacement of the ends of the broken bone.

In compound fractures the bone is broken and a wound extends from the bone out through the skin. The wound in a compound fracture may be caused by one or both ends of the broken bone being forced out through the tissues and skin or by some object piercing the skin and tissues to the bone and breaking it.

Broken bones, especially the long bones of the arms and legs, often have sharp, saw-tooth edges; even slight movement may cause the sharp edges to cut into blood vessels, nerves, or muscles, and perhaps through the skin. Therefore by careless or improper handling a simple fracture can be converted into a

compound fracture, or by damage to surrounding blood vessels or nerves the injury can be made much more serious. A person handling a fracture should always bear that in mind. Damage done by careless handling of a simple fracture may greatly increase pain and shock, cause complications that will prolong the period of disability, and endanger life through hemorrhage of pierced blood vessels.

The general symptoms of fractures are:

(1) Pain in the region of the fracture.

(2) Loss of function in the case of long bones.

(3) Deformity or irregularity of the part.

(4) Moderate or severe swelling.

(5) In fractures of the extremities the limbs usually are shortened.

Care must be exercised in the examination of all injured persons, particularly those suffering from fractures. Do not attempt to change the position of an injured person until you have made a careful examination. Do not permit a person to sit up until after you have examined him and are certain that the change of position will not complicate his injuries. If the person is lying down, it is far better to dress his injuries in that position with as little movement as possible. If fractures are present, any necessary movement should be made in a manner to protect the injured part against further injury.

In fractures of the extremities where fixed traction is not to be used, cautiously place the limb in as nearly a natural position as possible by taking hold of the lower part of the limb well below the fracture but not pulling on the limb, while an assistant supports the under part of the limb on either side of the break. Appropriate padded splints are then applied.[6]

In a compound fracture a tourniquet should be applied before the limb is moved. If there is arterial bleeding, the tourniquet

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[6] For dressing fractures of the long bones of the extremities where fixed traction is used see page 196.

should be tightened; otherwise it is left in place, loose but ready to be tightened if arterial bleeding occurs while the limb is being handled and the splints applied. The wound should be dressed with a sterile bandage compress and cover bandage as previously described for wound and bleeding of that location. The knots of the bandage compress and cover bandage should not be tied over the wound. The padding of the splint should be so arranged that the wound area is well-arched to prevent pressure over the ends of the broken bone and also around the tourniquet so that it can be tightened or loosened freely.

Insofar as possible, splints should be applied to fractures or suspected fractures before the patient is moved. Shock usually follows fractures and should be treated as early as possible. Medical care should be obtained promptly for all fractures.

PLACING BANDAGES FOR SPLINTS

To facilitate the placing of bandages, a thin stick or splint may be used. Natural arches afford enough clearance where the bandages may be slipped under the body or limbs. After the bandages have been passed under, they can be gently moved up or down to the position in which they are to be tied.

If the loop or St. John's tie is to be used, the bandage is passed under the part doubled. Hold the ends of the cravat at one side of the splint, and draw the loop to the point where it is to be tied, usually near the outside edge of the splint. Pass one end through the loop in one direction, and pass the other end through the loop in the opposite direction; the two ends are then brought together on the outside of the loop, and the bandage drawn tight and tied with a square knot. The loop or St. John's tie may be used in applying splints to the lower extremities, except ties at the knee in fractures of the knee and for fractures of the foot. In a very few exceptions, mentioned in the dressings for particular fractures, the bandages securing splints are tied at locations away from the splints.

FRACTURE OF SKULL

A fracture of the skull is a break in the bony structure forming the skull. The break may occur on the top, front, sides, or back of the head. A fracture of the skull is always serious due to possible injury to the brain. The skull may be fractured without visible wound of the scalp.

The injured person may or may not be conscious. If the fracture is at or near the base of the skull a mixture of blood and serum may flow from one or both ears. Bleeding from the mouth and nose and into the eyes also may be present. If the pupils of the eyes are unequal in size the brain has been damaged either by pressure or hemorrhage into it. Concussion of the brain may be confused with fracture of the skull, but as the care for both is much the same there is no need to distinguish between them. All serious injuries to the head should be considered as possible fractures of the skull, and if doubt exists treat them as such.

Keep the patient lying down with the head raised by a pad. Turn the head to such a position that it rests away from the location of the suspected fracture. If a wound is present control bleeding, and dress it. The knots of the bandage compress and cover bandage are tied away from the wound to prevent depressing fragments of bone into the brain. Cold applications may be applied to the head in the region of the fracture. Keep the patient warm, and treat for shock, which is usually severe. Never give a stimulant. In all severe head injuries keep the patient lying down. Where the patient has been unconscious, even for a short time, do not permit him to get up until he has been examined by a physician. Obtain medical care promptly.

FRACTURE OF NOSE

A fracture of the nose usually is not difficult to detect due to the deformity. Such a fracture may be simple or compound. The symptoms are pain, bleeding, swelling, and deformity.

Apply a bandage compress, not too tight, as for wound of the nose. (See fig. 29, p. 107.) Send the patient to a physician.

FRACTURE OF UPPER JAW OR CHEEKBONE

In fractures of the upper jaw or cheekbone, where there are open wounds, treat as for wounds of the face. (See fig. 26, *C*, p. 105.) Send the patient to a physician. No dressing is needed in the absence of an open wound, but the patient should receive medical attention promptly.

FRACTURE OF LOWER JAW

In a fracture of the lower jaw the mouth is usually open, and saliva mixed with blood flows from one corner or both corners of the mouth. Talking is painful and difficult. The teeth of the lower jaw are uneven at the break, with some teeth loosened or knocked out.

Gently place the jaw in position so that the lower teeth are against the upper teeth. Place the center of a cravat bandage over the chin, and pass the ends around to the back of the head and tie. Place the center of a second cravat bandage under the chin, pass the ends over the cheeks to the top of the head, and tie. The ends of the two bandages are then brought together and tied separately, as for dislocation of the jaw. No wedge is placed between the teeth, as in dislocated jaw. (See fig. 61, p. 159.) The lower jaw should be held in place by an assistant while the dressing is being applied. Send the patient to a physician.

FRACTURE OF COLLARBONE

Fracture of the collarbone frequently is caused by a fall with the hand outstretched or by a blow on the shoulder. The arm of the injured side is partly helpless, and the injured shoulder

768735 O—48——13

is lower and tends to droop forward. The patient frequently keeps his forearm bent across the chest and supports the injured arm at the elbow with the other hand. An irregularity can be seen and felt along the fractured collarbone.

Place a pad about 3 inches thick, 4 inches wide, and 5 inches long beneath the arm, extending from the armpit down. Place the center of a cravat bandage on the outside of the arm just below the shoulder, carry around arm and pad just below the armpit to the back of the arm; then cross the ends and carry both ends across the back to the opposite shoulder, carry one end over the shoulder and the other end under the armpit, and tie on the front of the shoulder over a pad. This bandage should be tight enough to pull the shoulder on the injured side back. Place the center of a second cravat bandage on the outside of the arm just above the elbow, carry around the arm and the body, one end across the chest and the other end across the back, and tie on the opposite side of the chest over a pad. Place the arm in a triangular bandage sling with the hand raised about halfway up the chest. (See fig. 67.) An assistant should support the arm while the dressing is being applied. Send the patient to a physician.

FRACTURE OF SHOULDER BLADE

Fracture of the shoulder blade is not a common injury. It usually is caused by direct violence over the shoulder blade and generally results in a simple fracture with little displacement. The signs and symptoms are pain at the fracture, swelling, and inability to swing the arm backward and forward from the shoulder. There may be difficulty in locating the exact site of the fracture.

Place the forearm in a triangular bandage sling, and bind the arm securely to the chest with a wide cravat bandage extending from the point of the shoulder downward. Carry one end across the chest and the other end across the back, and tie under the opposite armpit. (See fig. 68.) A pad should be placed beneath the knot. Send the patient to a physician.

FIGURE 67.—Dressing for fracture of the collarbone: *A*, Dressing appplied, front view, without triangular sling; *B*, dressing applied, rear view, without triangular sling; *C*, complete.

FIGURE 68.—Dressing for fracture of shoulder blade.

FRACTURES OF UPPER EXTREMITY WHERE FIXED TRACTION IS NOT APPLIED[7]

Fracture of the arm, elbow, forearm, or wrist usually can be recognized by the pain at the fracture, swelling, deformity, and inability to use the arm below the point of fracture.

FRACTURE OF UPPER THIRD OF ARM

It is difficult to immobilize a fracture of the upper third of the arm bone. Bind the arm to the chest with a wide cravat bandage extending from the point of the shoulder downward. Carry the bandage around the arm and body, one end across the chest and the other across the back. Tie over a pad on the opposite side of the chest. Place the forearm in a triangular bandage sling. (See fig. 69.) If the fracture is a compound one, apply a tourniquet in the armpit and dress the wound before dressing the fracture. Send the patient to a physician.

FRACTURE OF LOWER TWO-THIRDS OF ARM, ELBOW, FOREARM, OR WRIST

The splint for fractures of the above parts is made of two pieces of board ¼ inch thick and 4 inches wide. One piece should be long enough to extend from 1 inch below the armpit to the point of the elbow and the other long enough to extend from the point of the elbow to 1 inch beyond the end of the middle finger. These boards should be fastened together securely to form an L-shaped splint and well padded. Apply the splint to the inner side of the arm and forearm after the

[7] For dressing of fractures of the long bones of the upper extremity where fixed traction is applied, see page 197.

FIGURE 69.—Dressing for fracture of upper third of arm.

forearm has been bent across the chest. Four narrow cravat bandages are used to hold the splint in place and are tied in the following order regardless of the location of the fracture: First cravat bandage around the splint and arm at the top of the splint, second cravat bandage around the splint and arm just above the elbow, and third cravat bandage around splint and arm just below the elbow; these three bandages are tied on the outside of the arm. The fourth cravat bandage is applied by placing the center of the bandage on the outside of the wrist, passing the ends around to the inside of the wrist and splint, crossing on the splint, and passing to the outside, crossing on the back of the hand, and carrying one end between the thumb and forefinger and the other end around the little-finger side; cross the ends on the splint and bring them around to the back of the hand and tie. Place the forearm in a cravat bandage sling. (See fig. 70.) If the fracture is a compound one apply a tourniquet in the armpit, and dress the wound before applying the splint. Send the patient to a physician.

FRACTURE OR CRUSHING OF BONES OF HAND OR FINGERS

In caring for the above injuries, apply a well-padded splint about ¼ inch thick, 4 inches wide, and long enough to reach from the point of the elbow to 1 inch beyond the end of the middle finger. Apply the splint to the inside of the forearm and hand by one cravat and one triangular bandage. Place the center of the cravat on the outside of the forearm just below the elbow, pass it around the forearm and splint several times, and tie it on the outside of the forearm. Place the base of a triangular bandage under the splint at the wrist, bring the apex around the end of the splint over the hand to a point above the wrist, carry the ends over the back of the hand to the wrist, and pass it around the wrist and splint, tying it on the back of the wrist. Bring the apex down over the knot and

FIGURE 70.—Dressing for fracture of lower two-thirds of arm, elbow, forearm, or wrist.

tuck it under. Place the forearm in a cravat bandage sling. (See fig. 71.)

If the fracture is a compound one, apply a tourniquet at the pressure point on the arm and dress the wound before applying a splint. Send the patient to a physician.

FRACTURE OF FINGER

The usual symptoms of fracture of the finger are pain, swelling, and deformity. Place a narrow padded splint under the broken finger and palm of the hand, and hold the splint in place by narrow strips of cloth. Pass one strip around the splint and the palm of the hand, and tie over the splint. Pass one strip around the finger and splint above the fracture, and tie over the splint. Pass one strip around the finger and splint below the fracture, and tie over the splint. Place the hand in a cravat bandage sling. If the fracture is a compound one, control bleeding, if necessary, at the pressure point on the arm and dress the wound. Where two or more fingers are fractured, dress as for a fracture or crushing of bones of hand or fingers. Send the patient to a physician.

FRACTURE OF RIB

Fracture of the rib usually is caused by a direct blow or by a severe squeeze and can occur at any point along the rib. The symptoms are severe pain on breathing, tenderness over the fracture, and inability to take a deep breath on account of the pain. In a thin person the fracture may be seen under the skin. Grating sometimes can be felt by placing the hand over the seat of the fracture. If the lung of a person has been punctured by a fractured rib, he may cough up frothy blood.

Use three medium cravat bandages to dress a fracture of the ribs. Locate the fracture, and place the center of the first cravat over the fracture; then carry ends around the body,

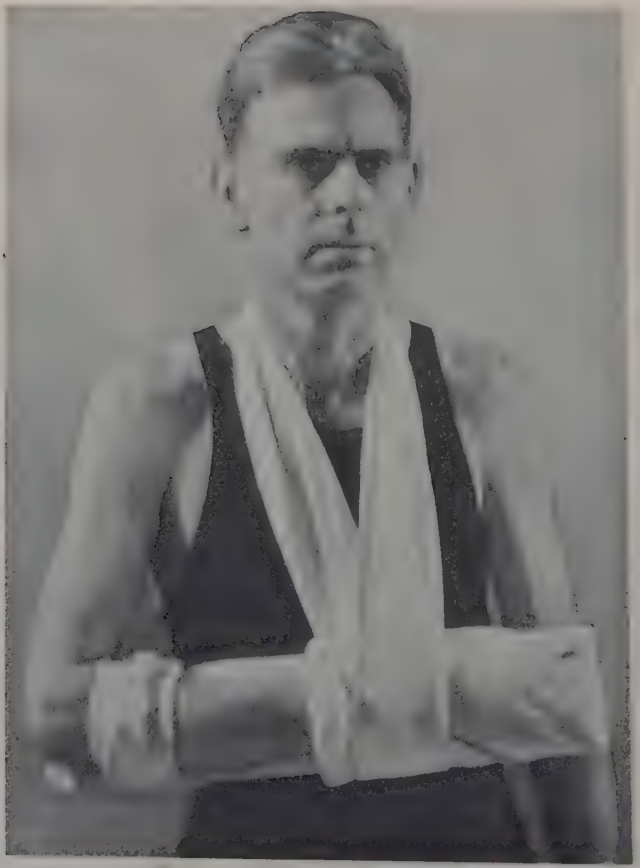

FIGURE 71.—Dressing for fracture or crushing of bones of hand or fingers.

and tie over a pad on the opposite side of the chest in a single knot. Have the patient exhale; as that is being done, pull the ends to tighten the bandage and tie. Place the center of the second cravat bandage overlapping the first one for its upper half, carry around the body, and tie over the pad already in place. Place the center of the third cravat bandage overlapping the lower half of the first bandage, carry around the body, and tie over the pad. (See fig. 72.) Send the patient to a physician.

FRACTURE OF SPINE

Fracture of the spine or backbone may occur at any point along the spinal column between its junction with the head at the top or its junction with the pelvic basin below.

In many cases of fracture of the spine, the spinal cord is injured. Where portions of the broken vertebrae are displaced, the spinal cord may be cut, or pressure may be made on the cord. There may be deformity of the backbone, or the back may show little deformity.

The back may be broken and the injury cause no damage to the spinal cord, but if the injured person is permitted to sit up or is improperly handled sections of the spinal column may be displaced, and severe damage may be caused to the spinal cord. All questionable injuries to the back, even in the absence of signs of paralysis, should be treated as for fracture of the spine.

When the spinal cord is cut or subjected to pressure, paralysis of the body occurs below the fracture. In all severe injuries to the back or neck *never* move the injured person until you have determined whether the neck or back is broken.

If the patient is conscious, ask him to move his legs and arms. If the legs cannot be moved and there is no fracture or dislocation of the legs, probably his back is broken and the spinal cord is cut or pressure is being exerted on it. If his arms as well as his legs cannot be moved and there is no fracture or dislocation of the arms, his spinal column is fractured high up, probably in the neck region.

FIGURE 72.—Dressing for fracture of ribs.

Paralysis may be determined in an unconscious patient by pinching or by sticking a pin or point of a knife blade into the feet and hands. If he is not paralyzed a reflex muscular action draws the hand or foot away from the pinched area or from the pointed object. If there is no reflex muscular action in the feet, the back is broken below the neck, and if there is no reflex muscular action in the hands, the neck is broken. The pin or knife blade used should be sterilized by dipping in an antiseptic solution or by holding in the upper portion of the flame of a match for about 10 seconds.

BROKEN NECK

A splint for a broken neck should always be applied with the patient lying on his back. If he is found lying face down or on his side, he must be turned on his back, using extreme care to keep his head on a line with his back and to prevent any movement of the neck whatsoever.

The splint used for broken neck or broken back is constructed of two long boards 6½ feet long, 6 inches wide, and 1 inch thick and three short boards 22 inches long, 4 inches wide, and 1½ inches thick. Place the first short board at a point corresponding to the shoulders of the patient (about 15 inches from the end of the long boards). Place the second short board at a point corresponding to the patient's hips. Place the third short board at a point corresponding to the patient's heels. Fasten the long boards to the crosspieces securely—by nails if possible—leaving a space between the long board in the center about 2 inches wide. The splint should be tested before a patient is placed on it.

For a broken neck, pad each long board separately with blankets, canvas, or clothing. A rolled-up single blanket tied on each long board of the splint provides the most effective padding.

In lifting the patient, raise him only high enough to push the splint under him, and take particular care to support the head,

neck, and shoulders to prevent movement in that region. Never raise the head, but keep it at all times on a level with the body. When the patient has been placed on the splint keep the head level with the body, and place extra padding on each side of the head and neck to prevent turning or sidewise movement.

Tie the body to the splint with 15 cravat bandages, as follows: Pass the first bandage around the forehead padding and splint, and tie on the outer side of the splint. Pass the second bandage around the splint and padding at the chin, and tie on the outer side of the splint. Pass the third bandage around the body and splint well up in the armpits, and tie on the outer side of the splint. Pass the fourth bandage around the body and splint at the lower part of the chest, and tie on the outer side of the splint. Pass the fifth bandage around the body and splint at the hips, and tie on the outer side of the splint. Place the center of the sixth bandage over one shoulder, pass the ends over the shoulder and crosspiece between the long boards, and tie on the front of the shoulder. Tie the seventh bandage in a similar manner around the other shoulder and splint. Pass the eighth bandage around one hip and crotch and crosspiece between long boards, and tie on the outer side of the splint. Apply the ninth bandage in a similar manner around the other hip. Pass the tenth bandage around the upper part of one thigh and the long board on that side, and tie on the outer side of the splint. Apply the eleventh bandage on the other side in a similar manner. Pass the twelfth bandage around the leg and long board on that side just below the knee, and tie on the outer side of the splint. Apply the thirteenth bandage on the other side in a similar manner. Pass the fourteenth bandage around one ankle and the long board on that side, and tie on the outer side of the splint. Apply the fifteenth bandage on the other side in a similar manner. All bandages around the body should be tied on the same side. (See fig. 73.) If the patient is unconscious, tie his arms at his sides with a cravat bandage around forearms, body, and splint, just above the wrists. Test the splint before placing the patient on it. Cover the patient

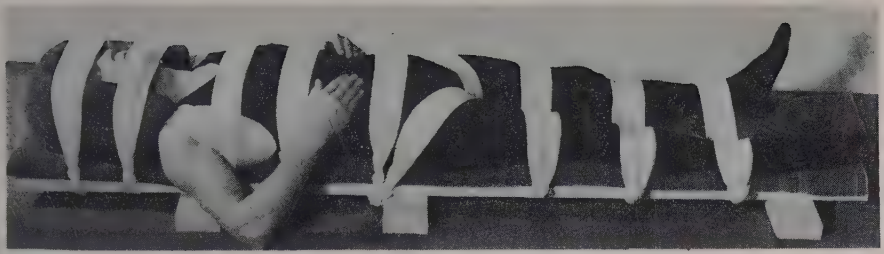

FIGURE 73.—Dressing for fracture of neck.

with a blanket, and treat for shock. The splint prepared as described above will serve as a stretcher, if necessary, but it is safer to transport on a standard stretcher. The patient should have medical attention as promptly as possible.

BROKEN BACK

A patient with a broken back should be placed on the splint face down. The splint described for a broken neck should be used, with additional padding. A blanket folded several times should be tied over the padding on the long boards, so that only the upper part of the chest rests on it. Padding of equal thickness should be tied over the padding on each long board, extending from the crotch downward to the ankles.

When the patient is found lying face down, he should be raised carefully with enough support along the back to prevent any movement and only high enough to push the splint under him. The splint is applied with 13 bandages in the same order as those for a broken neck, except that the bandage around the padding and the head and the bandage around the padding and the chin are omitted. The anchor bandages over the shoulders may be tied on the back of the shoulders.

If the patient is found lying on his back, do not attempt to turn him over until the splint is applied. Apply the splint to the front of the body (on top of the patient), tying the bandages in their regular order, except the anchor bandages around the shoulders. Bind the forearms to the sides of the body with a cravat bandage temporarily. Then gently and slowly roll the patient and splint to the face-down position. Next, the shoulder anchor bandages are placed. Test all bandages to make sure that they are tight enough. The forearms may be untied after the patient has been rolled over, for convenience in tying anchor bandages at the shoulders and testing tightness of bandages, but they should be tied again with crossed hands resting under his forehead when the patient is unconscious. (See fig. 74.) If the patient is found lying on

FIGURE 74.—Dressing for fracture of back.

768735 O—48——14

his side, he should be turned carefully so as to be face down. Extend his arms above his head and straighten his body before attempting to turn him. Support the entire back, with the turning movement exerted at the shoulders and hips simultaneously. The splint should be tested before the patient is placed on it. Cover the patient with a blanket and treat for shock. The splint will serve as a stretcher, if necessary, but it is safer to transport on a standard stretcher. The patient should have medical attention as promptly as possible.

FRACTURE OF PELVIS OR HIP

Fracture of the pelvis or hip usually results from a squeeze through the hips or a direct blow. Much importance is attached to the injury because it so frequently is accompanied by rupture of the bladder. The symptoms of this fracture are not easily detected; therefore, when the injured person complains of great pain through the pelvis, keep him lying on his back. Place the center of a wide cravat bandage over one hip, the upper end extending about 2 inches above the crest of the hip bone. Pass the ends around the body and tie over a pad on the opposite hip. In a like manner, place a second wide cravat bandage over the opposite hip, carry the ends around the body, and tie over the first bandage applied. Then place the patient on a well-padded broken-back splint or a board about 7 feet long, 12 inches wide, and 1½ inches thick. If he is lying face down, apply the splint before turning him over. If a broken-back splint is used, tie the body to the splints with eight cravat bandages, as follows: Pass the first cravat bandage around the splints and the upper part of the chest, well up in the armpits, and tie on one side near the splint. Pass the second cravat bandage around the splints and the lower part of the chest, and tie near the splint. Pass the third and fourth cravat bandages around the splints and thighs, just below the crotch, and tie on the outside near the splint. Pass the fifth and sixth cravat bandages around the splint and legs, just

below the knees, and tie on the outside near the splint. Pass the seventh and eighth cravat bandages around the splint and legs, above the ankles, and tie on the outside near the splint. (See fig. 75.)

If a board is used instead of a broken-back splint, each leg is not bandaged separately, but the bandages are passed over both limbs and tied near the board. Pad well between the legs to prevent movement before the bandages are applied. The broken-back splint or board should be tested before the patient is placed on it. Treat the patient for shock and get him to the doctor or a hospital at once, as an operation for rupture of the bladder offers hope of success only in the first hour or two. If the patient is unconscious a cravat bandage should be passed around the head and splint or board and tied. The forearms also should be tied folded across the chest, as described under Dislocation of Hip, page 165. The patient should be transported on a standard stretcher.

FRACTURE OF LOWER EXTREMITY WHERE FIXED TRACTION IS NOT APPLIED [8]

Fracture of the thigh, knee, leg, or ankle usually can be recognized by the pain at the fracture, swelling, deformity, and inability to use the part below the point of fracture. The splint for fractures of the lower extremity from the hip down, except the foot, consists of one piece of board 6 inches wide, 1 inch thick, and long enough to extend from the top of the shoulder to 3 inches beyond the heel. Pad the splint well, preferably by a folded blanket. Carefully raise the injured side of the person while the fracture is being supported, and place the splint under the body and leg. The splint is applied with seven cravat bandages for a fracture of the thigh, knee, kneecap, or ankle. For a fracture of the leg an extra bandage, if needed, may be placed between the knee and ankle.

[8] For dressing of fractures of the long bones of the lower extremities where fixed traction is applied, see page 201.

FIGURE 75.—Dressing for fracture of pelvis, using broken-back splint.

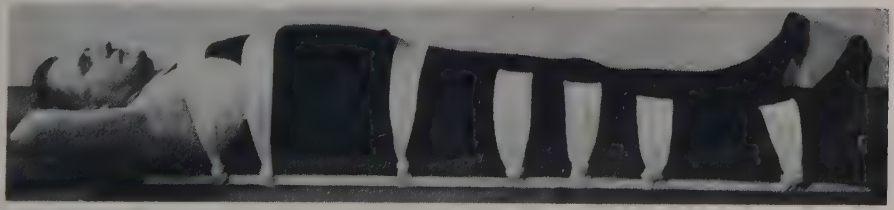

FIGURE 76.—Dressing for fracture of thigh, knee, or ankle.

FRACTURE OF THE THIGH, KNEE, OR ANKLE

With the first cravat bandage make one wrap of the upper end of the splint and padding opposite the armpits, crossing beneath the splint, with a short end on the injured side. This can be done best before the splint is placed beneath the patient. Pass the long end (an addition may be needed) around the body well up in the armpits, and tie to the short end on the injured side near the splint. Pass the second cravat bandage around the lower part of chest and splint, and tie on the injured side near the splint. Pass the third cravat bandage around the body and splint at the hips, and tie on the injured side near the splint. Pass the fourth cravat bandage around the thigh and splint just below the crotch, and tie on the outside near the splint. Pass the fifth cravat bandage around the thigh and splint just above the knee, and tie on the outside near the splint. Pass the sixth cravat bandage around the leg and splint just below the knee, and tie on the outside near the splint. Pass the seventh cravat bandage around the ankle and splint, and tie on the outside near the splint. (See fig. 76.)

The order of applying bandages for fractures of the lower extremity is the same from the top down, except for fracture of the kneecap.

FRACTURE OF KNEECAP

In fracture of the kneecap the splint for fractures of the lower extremity, described above, is used with the bandages above and below the knee replaced by bandages applied as follows: Place the center of a cravat bandage just above the kneecap and bring the ends around the limb and splint, cross at a point opposite the bend of the knee and bring the ends over the leg below the kneecap, but do not tie. Place the center of a second cravat bandage just below the kneecap, pass the ends

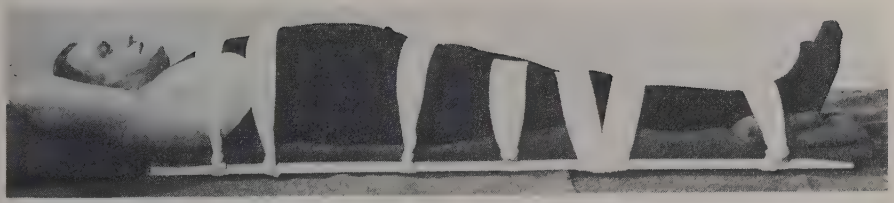

FIGURE 77.—Dressing for fracture of kneecap.

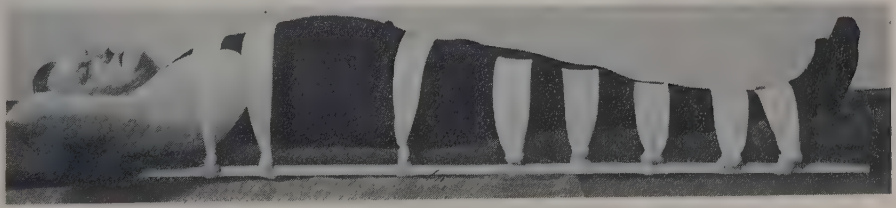

FIGURE 78.—Dressing for fracture of leg, showing use of extra bandage.

around the leg and splint, cross at a point opposite the bend of the knee, bring the ends over the thigh above the kneecap, and tie over the first bandage. Pull the ends of the first bandage tight and tie below the kneecap. (See fig. 77.)

FRACTURE OF LEG

When the leg is fractured, the splint for fractures of the lower extremity, described above, is used. Where the fracture is close to the knee or ankle an additional bandage, if needed, may be placed between the knee and ankle. (See fig. 78.)

For a compound fracture of the lower extremity apply a tourniquet at the thigh pressure point, unless the wound is above that pressure point, in which case apply the tourniquet to the groin pressure point and dress the wound before applying the splint. Cover the patient with a blanket and treat for shock. Send the patient to a physician.[9]

FRACTURE OR CRUSHING OF BONES OF FOOT OR TOES

Such fractures are caused by direct or indirect violence. The symptoms are pain, swelling, and deformity.

Apply a well-padded splint about 4 inches wide, ½ inch thick, and long enough to reach ½ inch beyond the heel to ½ inch beyond the great toe. This splint is applied with two cravat bandages. Start the center of the first bandage around the ankle from the back just above the heel. Cross over the arch, carry under the foot and the splint, bring up around the heel cross, and tie in the front. Start the center of the second cravat bandage on top of the toes, carry the ends around foot and splint several times, and tie on top of the foot. (See fig. 79.)

If there is a compound fracture, apply a tourniquet at the thigh pressure point and dress the wound before applying splint. Send the patient to a physician.

[9] When a splint as described cannot be obtained improvised splints which will take care of this type of fracture in the best possible manner should be used.

FIGURE 79.—Dressing for fracture or crushing of bones of foot or toes.

FIXED TRACTION IN APPLYING SPLINTS FOR FRACTURES OF THE LONG BONES OF THE EXTREMITIES [10]

Fixed traction in applying splints for fractures of the long bones of the extremities has gained wide use in recent years. By fixed traction, the ends of broken bones are drawn as near as possible to their normal position and held in that position by traction from above and below the fracture.

A fracture is not only a broken bone but injured soft parts, muscles, blood vessels, and nerves, as well. In fact, the damage to the soft parts, separately and collectively, may be and often is more serious than the broken bone when considered in the light of functional results.

A fracture of the shaft of a long bone transported without adequate splinting and fixation results in added injury to blood vessels, muscles, and nerves. The limb should be placed as nearly as possible in a position of muscular equilibrium. The

[10] Use of fixed traction in applying splints for fractures of the long bones of the extremities will be included as part of the Bureau of Mines standard first-aid course on request of the company physician or surgeon.

original trauma causes nerve injuries in 24 percent of fractures, and improper splinting increases those injuries to 42 percent.

The earlier reduction is attempted, the easier is its accomplishment. Early gentle traction and manipulation while the tissues are numb and the muscles are relaxed results in a very high percentage of reductions perfect enough to require little or no further adjustment. Delay permits coagulation of the blood in damaged soft parts, fibrin formation, and cellular exudation with consequent loss of tissue elasticity. Such are the effects of delayed fixed traction.

Experienced industrial surgeons claim that where fixed traction has been applied there is:

Marked decrease in the severity of shock.
Considerably less pain.
Less damage to surrounding tissues, blood vessels, and nerves.
A reduction in the length of disability, hence less loss of working time.

Fixed traction in splinting the long bones of the extremities may be made with specially prepared wire splints of the Thomas type or with wood splints.

In fractures of the extremities where fixed traction is to be used, cautiously place the limb in as nearly a natural position as possible by taking hold of the lower part of the limb well below the fracture and pulling gently but steadily until the limb is approximately normal in length. This can be judged by comparison with the opposite limb if it is not injured. Appropriate splints are then applied, with traction maintained on the fractured limb.

FIXED TRACTION IN SPLINTING FRACTURES OF UPPER EXTREMITY

Fixed traction can be used for fractures of the long bones of the upper extremity for any break between the shoulder and the middle of the forearm.

The most generally used wire splint is the Murray-Jones full ringed splint, with the ring hinged to the side bars. This splint can be applied to either arm. The ring encircles the arm and fits into the armpit below and over the shoulder above. Traction is made before the splint is applied. One person grasps the fractured limb at the wrist and applies steady, gentle traction, at the same time straightening the limb to a position as nearly normal as possible. While traction is maintained, by shifting the hands of the person making tractions at and above the wrist, the ring of the splint is extended up the arm so that it fits into the armpit below and over the shoulder above. Appropriate padding should be placed under the part of the ring in the armpit so as not to interfere with circulation. When the splint is in place the side bars extend down the extremity, with one bar on the thumb side and the other bar on the little-finger side.

To maintain fixed traction, place the center of a cravat bandage on a small, strong stick or similar object about 7 inches long so that the ends will extend beyond the side bars of the splint. Place the wrapped stick crosswise in the palm of the hand and fold the fingers around it, letting the ends of the bandage hang down. Place a second cravat bandage on the back of the wrist, pass the ends around the wrist and cross them on the back of the hand, then pass them over the fist and tighten firmly. Carry the ends to the underside of the wrist and tie a single knot, encircle the wrist, and tie on the back of the wrist.

The ends of the bandage extending from the stick are carried to a notch at the end of the splint and tied tightly enough to maintain fixed traction. If greater traction is needed, a stick may be inserted under the knot between the ends of the bandage and end of the splint and traction increased by twisting. The ends of the stick in the hand resting on the side bars of the splint prevent rotation of the bones in the forearm, by twisting the wrist. The limb should be brought to as near normal length as possible. This may be judged by comparison with the limb

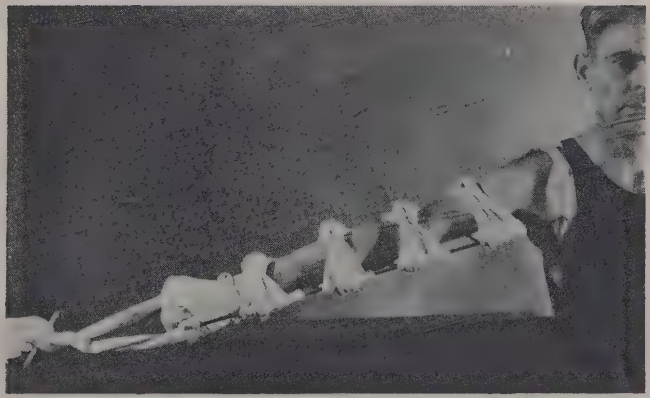

FIGURE 80.—Dressing for fracture of upper extremity by fixed traction, using Murray-Jones prepared splint.

on the opposite side, if it is uninjured. When enough extension has been made, the stick used for twisting should be anchored.

The extremity is then cradled in the splint by means of four cravat bandages. Place the center of the first cravat bandage between the arm and splint just below the armpit, cross the ends under the arm and carry around the splint and arm, and tie on the outside of the arm. Apply the second cravat bandage in a similar manner just above the elbow. Apply the third cravat bandage in a similar manner just below the elbow. Apply the fourth cravat in a similar manner above the wrist. (See fig. 80.)

FIGURE 81.—Dressing for fracture of upper extremity by fixed traction, using wood splint.

A wood splint may be used in place of the prepared wire splint. A board 4 inches wide, ½ inch thick, and long enough to extend from the armpit to 3 inches below the end of the middle finger will serve the purpose. The end of the splint to be placed in the armpit should be cut in a wide V about 1½ inches deep. The splint should be padded well, especially the end going into the armpit, to avoid interference with circulation.

The same procedure of traction as described for the wire splint is applied before the splint is placed. In the wood splint,

the ends of the bandage from the stick in the fist are carried down to the end of the splint; then the bandage ends are spread, crossing each corner, brought together, and tied on the end of the splint with traction sufficient to extend the limb to normal length.

The wood splint is applied with four cravat bandages encircling the splint and limb at places similar to those for the wire splint. (See fig. 81.)

When there is a compound fracture, apply a tourniquet at the arm pressure point and dress the wound before applying the splint. If an end of a bone is protruding, place a sterile compress temporarily over end of bone and wound before traction is applied. After the end of the bone has been pulled within the wound, remove the temporary compress, replace with a fresh sterile bandage compress, and complete the wound dressing. An antiseptic may be applied to the end of a protruding bone and the wound. The kind of antiseptic used should be one recommended by the company physician or surgeon. Wrap patient in a blanket while limb is being splinted. Treat for shock. Send patient to a physician as early as possible.

FIXED TRACTION IN SPLINTING FRACTURES OF LOWER EXTREMITY

Fixed traction can be used for fractures of the long bones of the lower extremity for any break between the hip and the foot.

The most generally used wire splint is the Keller-Blake half-ringed hinged splint. The half ring fits around the under part of the thigh at the crotch and is held in place by a strap passing over the outside of the thigh from above. This splint can be applied to either limb.

One person grasps the foot with or without the shoe on, keeping the foot at a right angle to the leg with the toes pointing up. Steady gentle traction is made, and at the same

time the limb is straightened to a position as nearly normal as possible.

While traction is maintained, the splint is placed in position by slipping the half-ring under the upper portion of the thigh with the short side bar on the inside. When the half-ring engages in the crotch, the strap over the thigh is tightened.

To maintain fixed traction, place the center of a cravat bandage under the foot and carry the ends up the leg. Pass a second cravat bandage around the ankle several times and tie loosely. Bring the ends of the first bandage down over the circular bandage, carry to the notch at the end of the splint, and tie, tightening the knot enough to apply the needed traction. If greater traction is needed, a stick may be inserted under the knot between the ends of the bandage and the end of the splint and traction increased by twisting. The limb should be brought to as nearly normal length as possible. This may be judged by comparison with the limb on the opposite side, if it is uninjured. When enough traction has been made, the stick for twisting should be anchored.

The extremity is then cradled in the splint by means of five cravat bandages. Place the center of the bandages between limb and splint, cross ends under the limb and splint, carry them around the splint and limb, and tie on the top of the limb. Place the first bandage just below the crotch, the second just above the knee, and the third just below the knee. When a leg is fractured, place the fourth and fifth bandages so that if possible both of them are below a break. When the fracture is near the ankle, the fourth bandage is placed about the middle of the leg and the fifth bandage is placed at the ankle. (See fig. 82.)

A wood splint may be used in place of the prepared wire splint. The wood splint should be a board long enough to reach from the top of the shoulder to 5 inches beyond the heel, 6 inches wide, and 1 inch thick. The splint should be well padded, preferably with a folded blanket.

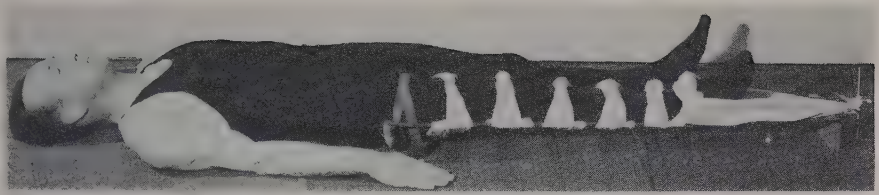

FIGURE 82.—Dressing for fracture of lower extremity by fixed traction, using Keller-Blake prepared splint.

The same procedure for traction as described for the wire splint is applied before the splint is placed. As the splint must be anchored at the top so as not to slip when traction is made on it from below, the center of a wide cravat bandage is unfolded and placed half over and half under the upper end of the splint, the ends being carried around the splint and tied very tightly on the underside. To each of the ends is tied an end of a cravat bandage. This should be done before padding is applied.

While traction is being maintained and the fracture supported carefully, raise the injured side of the patient, and place the splint under the body and limb. The ends of the cravat bandages joined to the bandage tied to the upper end of the splint are carried around the body and splint at least twice, just below the armpits, and tied on the injured side as near the splint as possible. A second cravat bandage is carried around the body and splint at the lower part of the chest and tied on the injured side near the splint. A third cravat bandage is carried around the body and splint at the hips and tied on the injured side near the splint. Four additional cravat bandages are carried around the limb and splint and tied on the outside of the splint—one just below the crotch, one on the lower part of the thigh, one just below the knee, and one above the ankle. The bandages above the break are tied; from top of splint downward; then fixed traction is completed by carrying the ends of the traction bandage at the ankle (described under wire splint) to the end of the splint; then the bandage ends are spread crossing each corner, brought together, and tied on the end of the splint so as to form a loop. Traction adequate to extend the limb to normal length should be made by placing a stick or similar object in the loop and twisting. After traction has been made, the bandages below the break are tied from the fracture downward. (See fig. 83.)

When there is a compound fracture apply a tourniquet at the pressure point on the thigh, and dress the wound before

FIGURE 83.—Dressing for fracture of lower extremity by fixed traction, using wood splint.

applying the splint. If an end of a bone is protruding, place a sterile compress temporarily over the end of the bone and wound before applying traction. After the end of the bone has been pulled within the wound, remove the temporary compress, replace with a fresh sterile bandage compress, and complete the wound dressing. An antiseptic may be applied to the end of a protruding bone and the wound. The kind of antiseptic should be one recommended by the company physician or surgeon. Wrap the patient in a blanket while the limb is being splinted. Treat for shock. Send the patient to a physician as promptly as possible.

BUREAU OF MINES GENERAL-UTILITY SPLINT STRETCHER

The Bureau of Mines general-utility splint stretcher is a modification of its broken-back splint. It is permanently assembled and has pipe runners to give added strength and afford handholds.

It is constructed of white pine wood, dressed and free from knots or other defects. The two long boards are 78 inches by 6 inches by 1 inch. The cross members are 21 by 4 by 1½ inches.

The long boards are spaced 2 inches apart. The cross member at the head end is set back 15 inches from the ends of the long boards and permanently fastened to them by wood screws. The cross member at the feet end is set back 2 inches from the ends of the long boards and permanently fastened by wood screws. The center cross member is not attached to the long boards but, as will be explained later, is movable up and down the long boards by its attachment to the pipe runners.

The pipe runners are ¾-inch wrought-iron conduit pipe 96½ inches long and are threaded and capped at the ends.

The pipe runners are attached to the under surface of the cross members where they project beyond the long boards. At the upper and lower cross members the pipe runners are

anchored by wrought-iron straps around the pipe and bolted through the cross members by ¼-inch carriage bolts. The center cross member is attached to the pipes by a bronze strap, the inner bolt being permanent and the outer having a wing nut. The bronze strap is so sprung that when the wing nut is loosened it tends to disengage the pipe, thus making the center cross member adjustable up and down the long boards.

The pipe runners are attached to the cross members, so at the head end they extend 7½ inches beyond the splint and at the feet end 11 inches beyond the splint. This difference in the projection of the pipes at the two ends is necessary for carrying.

The splint stretcher weighs approximately 40 pounds. (See fig. 101, p. 251.) The splint stretcher is very sturdy and will stand continued hard usage. It can be constructed in any plant or mine carpenter shop for a couple of dollars. It is believed that its sturdiness and low cost will permit placement about plants and mines to be available when needed. A blueprint showing construction details may be obtained on request from the Safety Division of the Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa.

Among the injuries for which the splint stretcher can be used are dislocated hip, dislocated knee, fracture of neck, fracture of back, fracture of pelvis, and all fractures of the lower extremity with or without fixed traction.

POISONS

Many substances are poisonous to the human body, and unless this text were extended far beyond the confines of a handbook, a manual of first aid could not deal with all of them. It is not expected that a first-aid man could become familiar with the treatment of persons affected by all the different kinds of poisons or that he should be able to recognize the symptoms of each. It is essential, however, that he should be able to care

for the more common poisons and to render general first aid to all cases, irrespective of the poison received. His first duty is to send for a physician immediately and then to render such treatment as will relieve and protect the patient until medical aid arrives. Always save any receptacle suspected to have contained the poison and retain samples of any vomited matter. These should be turned over to the physician on his arrival, as they may be of material aid in determining the nature of the poison received.

PREVENTION OF POISONING

Always keep poisonous substances plainly labeled, segregated at a point inaccessible to children, and away from food and nonpoisonous medicines. Never take a supposed medicine in the dark. Always read the label on the container before taking drugs. If the label is missing or illegible, do not take a chance with an unknown substance.

Poisons may gain entrance to the body through several channels:

They may be taken by mouth and swallowed, either intentionally or by mistake.

They may be breathed in with inhaled air, in the form of certain noxious dusts, gases, fumes, or mists.

They may be injected within the skin by bites of poisonous snakes, insects, or rabid animals and by hypodermic injections; bacteria may gain entrance through open wounds.

They may enter through contact with the skin (organic and inorganic cutaneous irritants, poisonous plants, and certain fungi); or they may be absorbed through the skin (mercury, certain poisonous liquids, and gases).

POISONING BY MOUTH

For the purpose of first aid the poisons entering the human body by mouth are divided into three general groups, according

to their action: Corrosive poisons, irritant poisons, and systemic poisons. The effects of some poisons fall into two or even all three of these groups.

CORROSIVE POISONS

The corrosive poisons are substances that corrode, burn, or eat into the tissues when they come in contact with the mucous membrane of the lips, mouth, throat, gullet, and stomach. Besides the immediate corroding action on the tissues they touch, they excite an inflammatory condition of the deeper tissues and in some instances through absorption exert harmful effects on the entire system. Physical shock frequently is present in cases of corrosive poisoning.

The more common corrosive poisons are the strong acids and the strong alkalies.

Corrosive acids

Hydrochloric acid.
Sulfuric acid.
Nitric acid.
Oxalic acid.
Carbolic acid.
Lysol.

Corrosive alkalies

Potash or caustic potash.
Soda or caustic soda.
Lye.
Unslaked lime.
Strong ammonia water.

If he is not unconscious and if the act was not intentional, a person who has swallowed a corrosive poison usually will identify the poison taken. If the poison container is available it will aid in identifying the type of poison taken.

The lips and mouth are stained and show evidence of searing or burning.

If conscious, the person will complain of severe pain in the mouth, throat, gullet, and stomach. There usually is intense thirst. There may be difficulty in talking and swallowing owing to swelling caused by the poison.

TREATMENT FOR CORROSIVE POISONS

Determine, if possible, whether an acid or an alkali has been taken.

Never give an emetic.

For acids, except *carbolic acid or lysol*, give lime water, chalk and water, milk of magnesia, or 1 teaspoon of baking soda in lukewarm water. Have the patient drink several glassfuls of any of the above.

For alkalies give a weak acid solution, such as equal parts of vinegar and water or lemon or orange juice and water. Have the patient drink several glasses of any of the above.

For either the acids or the alkalies dilute the poison and soothe the corroded tissues by repeated drinks of milk, raw eggs beaten in milk or water, olive oil, salad oil, flour beaten up with water, barley water, or a thin gruel made from the soft cereals.

Watch for physical shock and treat it at once if present.

CARBOLIC ACID OR LYSOL POISONING

The bottle containing the poison may be found and the poison identified.

The odor of carbolic acid or lysol will be noted on the breath of the patient. The patient probably will vomit, and the vomited matter will have the characteristic odor of carbolic acid or lysol. The general symptoms are those due to corrosive poisons.

Treatment of carbolic acid or lysol poisoning.

Wash out mouth with equal parts of *grain alcohol* and water.

Permit patient to have repeated small drinks of whiskey or brandy in equal parts with water or wine undiluted.

In the absence of alcoholic liquors, give the whites of raw eggs beaten up in water, soapsuds, or dilute vinegar in repeated doses of a glass at a time. Do not give milk or oils until the stomach has been completely emptied.

Later give the patient large quantities of salt water, mustard water, or alum water—1 tablespoon to a glass of lukewarm water. Several glasses of any of the above will dilute the poison and promote vomiting.

After the patient has vomited, give Epsom or Glauber's salts or sodium phosphate to aid in eliminating any of the poison that may have entered the circulation.

When the stomach has been emptied, milk, gruel, or flaxseed tea may be given to soothe the corroded tissues.

Watch for physical shock and treat it promptly. Artificial respiration will be required if breathing ceases.

IRRITANT POISONS

The irritant poisons are substances that when swallowed set up an irritation within the stomach manifested by distress, nausea, vomiting, and severe pain. With most of the irritant poisons these symptoms are caused by direct irritation of the membrane lining the stomach, but with others there is a secondary action through absorption.

The more common irritant poisons are mainly the metals or the salts of metals:

Antimony and many of its combinations.
Arsenic and many of its combinations.
All the combinations of copper.
Iodine and many of its combinations.
All the combinations of lead.
All the combinations of mercury.
Phosphorus and many of its combinations.
Silver nitrate.
All the combinations of zinc.

SYMPTOMS

Many irritant poisons do not stain the lips or mouth. Tincture of iodine gives the characteristic iodine stain. Silver nitrate stains the lips, first whitish and later dark to black. Strong salts of mercury and zinc corrode the lips and tongue, which appear white and shriveled. A metallic taste in the mouth is a common symptom in most of the irritant poisonings. Pain in the stomach followed by nausea and vomiting are common to all cases of irritant poisoning. Prostration and physical shock usually are present in the more severe cases.

TREATMENT FOR IRRITANT POISONS

Determine, if possible, the kind of poison taken.

Promote vomiting, and empty the stomach as soon as possible. Give salt water, mustard water, or alum water—1 tablespoon to a glass of lukewarm water. Repeat the above until the patient has vomited several times.

After the stomach has been emptied give the whites of eggs in water or milk (except in *phosphorus poisoning*), barley water, or thin gruel made from the soft cereals.

Watch for physical shock, and treat it if necessary.

Special treatment for iodine poisoning.

Give large quantities of starch mixed with water or a thin paste of flour mixed with water before attempting to promote vomiting or even if vomiting has already occurred. Follow with general irritant-poisoning treatment.

Special treatment for copper or mercury poisoning.

Give whites of eggs beaten up with water or milk before attempting to promote vomiting or even if vomiting has already occurred. Follow with general irritant-poisoning treatment.

Special treatment for phosphorus poisoning.

Do not give any oil or fat. After stomach has been emptied, give Epsom or Glauber's salts. Follow with general irritant-poisoning treatment.

Special treatment for silver nitrate poisoning.

Give drinks of strong salt water immediately. Follow with general irritant-poisoning treatment.

The irritant metallic poisons discussed above are those that have caused acute poisoning. Many of the metallic poisons may occur in insufficient quantities to cause acute poisoning but cause chronic poisoning by accumulation within the system. In the chronic poisonings the symptoms appear gradually, becoming more and more severe and more widely distributed throughout the body.

SYSTEMIC POISONS

The systemic poisons affect the body as a whole through their action on various systems, organs, or tissues. The systemic poisons are divided into two general groups: (1) The depressant poisons, whose general action is that of a narcotic (sleep producing), with progressive lowering of the vital functions of the circulation and respiration; and (2) the convulsant poisons that produce spasms or convulsions, with rapid paralysis of the vital functions of the circulation or respiration, or both.

DEPRESSANT POISONS

The more common depressant poisons are:

- Alcohol in excess.
- Opium and its derivatives:
  - Laudanum.
  - Paregoric.
  - Morphine.
  - Heroin.
- Drugs to produce sleep or relieve pain:
  - Chloral.
  - Veronal.
  - Sulfonal.
  - Trional.
  - Sleep-producing and pain-relieving preparations taken in excess.

Alcoholic poisoning.—The patient has the odor of alcohol on his breath. He is partly or completely unconscious, although usually he can be aroused temporarily but soon relapses into a stupor. He often mutters in delirium. In the early stages the face is moist and flushed, the pulse strong, and the breathing deep. Later the face becomes dry and bloated, with a bluish cast, the pulse becomes weak and rapid, and the breathing is shallow. The eyes are bloodshot, and the pupils are natural or large but of equal size.

Never accept the odor of alcohol on the breath as a positive sign of alcoholic poisoning. Always examine for other conditions to account for the patient's disability. A person who is not feeling well often takes a drink of alcoholic liquor to brace him up, and the real condition causing his illness may be overlooked. Frequently a person who has indulged in alcoholic liquors suffers an accident and needs care for some injury. The conditions most likely to be confused with alcoholic poisoning are a fractured skull and apoplexy. In a fractured skull there may be no external evidence of a head injury. Always carefully examine the eyes of a person believed to be suffering from alcoholic poisoning. If the pupils of the eyes are of unequal size when compared with each other, there is some injury to the brain—a fractured skull, hemorrhage within the brain (apoplexy), or some pressure exerted on it.

Treatment for alcoholic poisoning.

Procure medical aid promptly.

Arouse patient, if possible, and give salt water, mustard water, or soapy water to promote vomiting.

Follow by warm black coffee, a cup every 15 minutes.

Give aromatic spirits of ammonia by mouth, if possible; if not, by inhalations at frequent intervals.

Keep patient warm, and combat physical shock.

If respiration becomes very shallow, resort to artificial respiration and oxygen inhalation.

Poisoning by opium and opium derivatives.—The symptoms of poisoning by opium or opium derivatives are weariness, sleepiness, and a progressive loss of sensibility. The face is pale or cyanosed, and the skin is cold. The eyes are clear, but the pupils are contracted to a pinpoint and do not react to light. The pulse is at first strong and slow but later becomes rapid and feeble. The respiration at first is slow but later becomes shallow and irregular. Whenever the pupils of both eyes are unusually small and do not react to light, always suspect that opium or an opium derivative has been taken.

Treatment of opium or opium derivative poisoning.

Procure medical aid immediately.

Arouse the patient by dashing cold water on the face and slapping the soles of the feet. Walk him up and down to keep aroused.

Promote vomiting by drinks of salt water or mustard water if the patient can be aroused sufficiently to swallow.

If possible, have the patient take repeated drinks of strong black coffee or tea.

Stimulate with aromatic spirits of ammonia by mouth or inhalation at frequent intervals.

Keep patient warm.

If respiration becomes very feeble, resort to artificial respiration and oxygen inhalation.

Poisoning by chloral, veronal, sulfonal, trional, or sleep-producing or pain-relieving preparations taken in excess.—The symptoms of poisoning by the above substances vary somewhat, but the more common ones are drowsiness, sleepiness, and insensibility ranging to deep coma. The face usually is pale, but with some preparations the face may be cyanosed. In most cases the skin is cold and often covered with a cold sweat. The temperature usually is subnormal. The pulse at first is slow but later becomes rapid and weak. The respiration at first is slow but later becomes shallow and irregular.

Treatment.

Procure medical aid promptly.
Arouse patient if possible, and keep him awake.
Promote vomiting by drinks of salt water or mustard water.
Give black coffee or strong tea at frequent intervals.
Keep patient lying down and warm.
Give aromatic spirits of ammonia by mouth, if possible; otherwise by inhalations at frequent intervals.
If respiration becomes very shallow, resort to artificial respiration and oxygen inhalation.

CONVULSANT POISONS

The more common convulsant poisons are:
Nitroglycerin.
Hydrocyanic acid and the cyanides.
Strychnine.

Poisoning by nitroglycerin.—Mild nitroglycerin poisoning frequently occurs among men who handle explosives, the contents of which are high in nitroglycerin. Some persons are highly susceptible to nitroglycerin and should never handle or be around explosives containing it.

The symptoms of nitroglycerin poisoning are a queer, full sensation of the head, giddiness, headache in the frontal region and extending to the back of the head and neck with increasing severity, irregular pulse, dilation of pupils of the eyes, pain in the front of the chest, muscular weakness, nausea and vomiting, loss of consciousness, and epileptiform convulsions in extreme cases.

Treatment of nitroglycerin poisoning.

In *mild* cases get the patient into fresh air as soon as possible, and stimulate with aromatic spirits of ammonia and black coffee. Very little can be done to relieve the headache. It will gradually decrease with time, ranging from several hours to a day or more. Keep the patient warm.

Severe cases should have medical attention immediately.

Keep the patient lying down and warm.

Promote vomiting by drinks of salt water or mustard water.

Stimulate the patient with aromatic spirits of ammonia, black coffee, or strong tea.

If respiration fails, resort to artificial respiration and oxygen inhalation.

Poisoning by hydrocyanic acid or the cyanides.—The symptoms of poisoning by hydrocyanic acid or the cyanides are rapid and progressive. The breath may have the odor of bitter almonds; other symptoms are giddiness, nausea and vomiting, decreased sensibility, panting respiration, cyanosis, profound collapse, convulsions with prolonged expiration, and respiratory failure.

Treatment of poisoning by hydrocyanic acid or the cyanides.

Procure medical aid immediately, as life depends in most cases on prompt and proper medical care.

Keep patient lying down and warm.

If patient can swallow, promote vomiting by drinks of salt water or mustard water.

If patient can swallow, next give aromatic spirits of ammonia, black coffee, or strong tea. If he cannot swallow, give aromatic spirits of ammonia by inhalation, repeated frequently.

If respiration fails, resort to artificial respiration and oxygen inhalation. However, neither artificial respiration nor oxygen inhalation is of much benefit, because in such poisonings the body tissues are so affected that they cannot utilize the oxygen carried by the blood.

Strychnine poisoning.—The symptoms of strychnine poisoning progress very rapidly, as follows: There is a feeling of suffocation, the face becomes blue, muscles of the neck become rigid, neck becomes stiff, and convulsions occur in which the body of the patient arches upward so that he rests on the back of the head and on his heels; patient usually remains conscious and respiration ceases.

Treatment of strychnine poisoning.

Procure medical aid immediately, as the life of the patient usually depends on prompt and proper medical treatment.

Give several cups of strong tea.

Promote vomiting by drinks of salt water or mustard water.

Keep the patient absolutely quiet in a dark room.

Give no stimulant.

Do not try to restrain the patient while in convulsions.

If respiration fails, resort to artificial respiration and oxygen inhalation.

FOOD POISONING (PTOMAINE POISON)

Foods that have been kept improperly and have become decomposed or contaminated by certain types of bacteria are poisonous. Fish, shellfish, combinations of eggs with milk or cream, and canned foods are the most common sources of food poisoning. Such foods often are eaten by more than one person, hence cases seldom occur singly and thus indicate the cause.

The symptoms of food poisoning are headache, muscular pains, nausea, vomiting, weakness, purging, and, in severe cases, collapse. The symptoms in most cases appear soon after the contaminated food is eaten, but sometimes the onset is delayed for a number of hours.

Treatment of food poisoning.

Procure medical aid.

If vomiting has not occurred, promote it by drinks of salt water or mustard water.

Keep the patient in bed and warm.

Give a large dose of castor oil after vomiting has ceased.

Stimulate the patient with aromatic spirits of ammonia, black coffee, or strong tea.

If vomiting persists, give small drinks of soda water (1 teaspoon of baking soda to 1 glass of water).

MUSHROOM POISONING

Certain varieties of mushrooms are highly poisonous and if eaten will cause serious illness or even death.

The symptoms of mushroom poisoning occur 6 to 12 hours after the mushrooms have been eaten and are headache, nausea, vomiting, pain in the abdomen, and purging. Later there is great thirst, muscular twitching, or convulsions, weak, rapid pulse, cold, clammy skin, and delirium or stupor.

Treatment of mushroom poisoning.

Procure medical aid immediately.

Put the patient in bed and keep him warm.

Promote vomiting by drinks of salt water or mustard water.

Keep the patient stimulated by aromatic spirits of ammonia, black coffee, or strong tea.

Combat collapse by continued physical shock treatment.

POISONS BREATHED IN WITH INHALED AIR

The poisons that may enter the body with inhaled air are too numerous to be discussed in detail in a first-aid manual. They are the noxious gases, the more common of which have been covered under Dangerous Gases (see pp. 61 to 67). The dusts of metallic salts and the metallic fumes such as lead, mercury, and zinc are poisonous, but they usually do not manifest themselves as acute poisonings; instead, they develop over a period of exposure, with symptoms becoming progressively more prominent. The gases and mists of petroleum products and certain solvents also are poisonous but, except in a few instances, do not cause acute poisoning. Exposure must be repeated over varying periods before their effects are evident.

Workers who are exposed to dusts, fumes, mists, or gases and suffer from gastric disturbances, dizziness, headache, nausea, or body weakness should consult a physician and explain to him so far as possible the nature of the contaminants in the atmos-

phere in which they work. If this is done when the symptoms are first noticed, much chronic illness may be avoided.

Two acutely poisonous gaseous products incident to metallurgical work are hydrocyanic-acid gas and arseniuretted hydrogen. The symptoms are as given under cyanide poisoning (see p. 217) and arsenic poisoning (see p. 212), except that they are much more acute. The treatment for both gases is to remove the patient to fresh air at once, procure medical aid as early as possible, and administer first-aid treatment as for cyanide and arsenic poisoning.

POISONS INJECTED WITHIN THE SKIN

Many poisons may enter the body through breaks in the skin, such as infected wounds (see p. 98), drugs injected hypodermically, or bites of rabid animals, poisonous snakes, and poisonous insects. The last three are the only ones discussed.

BITES OF RABID ANIMALS

Any animal may suffer from hydrophobia or be rabid or mad. If a person is bitten by an animal always suspect the animal to be rabid until it is proved otherwise. The saliva from a rabid animal enters the wound caused by the bite, and the disease is transmitted to the person bitten. A person bitten by an animal always should receive medical attention.

The animal causing the injury should not be killed but should be confined for observation for at least 30 days to determine whether or not it is suffering from hydrophobia. If the animal is killed its head should be saved for microscopic examination of its brain. An animal suffering from rabies shows a marked change in its disposition, refuses food and often drink, and is very restless. Later paralysis develops so that its lower jaw hangs down and saliva drools from the mouth. In the later stages the hind legs become paralyzed and are dragged.

Treatment of bites by rabid animals.

Wash the wound with grain alcohol to remove saliva, if possible.

Dress with a sterile compress.

Take the patient to a physician at once.

BITES OF POISONOUS SNAKES

Coral snakes, copperheads, rattlesnakes, and water moccasins are poisonous, and their bites often are dangerous.

The first symptoms of bites by poisonous snakes are a feeling of a stinging pain and one or two small punctured wounds of the part struck, and swelling and discoloration which take place in a very short time; the part becomes painful, and as the poison enters the system through the venous circulation general symptoms develop, such as great weakness, nausea, rapid, weak pulse, and a profuse flow of saliva. After a few hours muscular paralysis develops, and the patient passes into a stupor.

Treatment of bites of poisonous snakes.

Keep the patient lying down and quiet to slow circulation and retard absorption of the poison.

Immediately apply a constricting bandage several inches above the wounds between the wounds and the heart. This retards the flow of blood into the superficial veins and prevents absorption of the poison.

An area several inches square around the wounds should be sterilized with a suitable antiseptic and then incised through each of the wounds by cuts about ⅛ inch deep and ½ inch long in the form of an X cross. A sharp knife, the tip of which has been held in the flame of a burning match, is satisfactory for making the incisions.

Press the outside of the wounds to make them bleed freely. To promote bleeding suck the wounds, and spit out the blood.

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No harm can come from sucking the wound if there are no sores in the mouth or on the tongue. Continue the bleeding for 20 minutes, then loosen the constricting bandage for 1 minute. Retighten the constricting bandage, and continue drawing blood from the wounds. Additional incisions may be made around the bites if much swelling takes place. Repeat this procedure until medical aid can be procured.

Treat the patient for physical shock if necessary.

Several pocket-size snakebite outfits are available. They consist of a web band similar to an army tourniquet with a device to hold it tight, a small lancet in a vial or case, iodine ampoules, or swabs, a suction syringe, usually of glass with a rubber extension to fit tightly around the wounds, ampoules of aromatic spirits of ammonia, folded paper cups, and adhesive compresses.

The advantage of these outfits is that there is readily at hand in a small pocket case everything needed for the first-aid care of a poisonous snakebite. For persons who frequent regions infested with poisonous snakes these pocket snakebite kits are a great first-aid convenience.

BITES AND STINGS OF INSECTS

Many insects bite or sting, but few are poisonous in the sense that their bite or sting can cause serious symptoms of itself. However, there are insects that do transmit diseases where the insects act as hosts to an organism or virus of those diseases. As examples, certain types of mosquitoes transmit malaria, yellow fever, and other diseases; certain types of ticks transmit spotted or Rocky Mountain fever; and certain types of biting flies transmit tularemia or rabbit fever.

The stings of bees, wasps, yellow jackets, and hornets and the bites of mosquitoes, ticks, fleas, and bedbugs usually cause only local irritation and pain in the region stung or bitten. Moderate swelling and redness may take place, while some itching, burning, and pain may be present.

Treatment of mild stings or bites.

If a sting is left in the wound withdraw it.

Apply a weak ammonia solution—aromatic spirits of ammonia answers the purpose—or a paste made of baking soda and water. These should be applied with a compress.

If swelling and pain persist and constitutional symptoms develop, medical care should be obtained.

Occasionally stinging or biting insects have been feeding on or in contact with poisonous substances and at the time of the sting or bite such substances may be injected into or come in contact with the wound made by the sting or bite, causing a poisoned or infected wound.

STINGS AND BITES OF SPIDERS, CENTIPEDES, TARANTULAS, AND SCORPIONS

The effects of stings and bites of spiders, centipedes, tarantulas, and scorpions in some instances are much more severe than those of the insects previously mentioned. They may cause alarming symptoms but seldom prove fatal except bites of tarantulas and black widow spiders.

The black widow spider is a moderately large, glossy, black spider with very fine hairs over the body, giving it a silky appearance. On the under side of the abdomen is a characteristic red or crimson marking in the form of an hourglass. The female only is poisonous; the male, which is much smaller, is harmless.

The symptoms of the more poisonous insects' stings or bites are one or two small pin-point punctures of the skin, local swelling, and redness with a smarting, burning pain. The swelling, redness, and pain increase rapidly, with prostration, sweating, nausea, and pain in the back, shoulders, chest, and limbs developing within a few hours. In most instances the constitutional symptoms are mild and subside within 6 to 12 hours, but occasionally they are severe and end in collapse.

Treatment of more poisonous stings and bites.

Treat as for the less poisonous bites or stings of insects.

Where the swelling and pain are rapid and severe, treat as for poisonous snakebite, and procure medical care as early as possible.

Keep the patient lying down and quiet to retard absorption of poison into the circulation.

Combat physical shock by administering aromatic spirits of ammonia, black coffee, or strong tea.

POISONING BY CONTACT WITH THE SKIN

Many inorganic and organic substances in the form of gases, fumes, mists, liquids, and dusts cause poisoning or dermatoses when they come in contact with the skin. Dermatoses are diseases of the skin and its appendages (hair follicles, sebaceous glands, and sweat glands) and are characterized by alterations in the normal structure, irritation, and inflammation.

Except in few instances, the dermatoses are not of rapid onset but manifest themselves gradually after continued exposure to the agents causing them. Employees who note changes in the normal texture of their skin or continued irritation or inflammation of the skin should seek medical advice before a chronic dermatosis develops. Needless discomfort and loss of time can be prevented by early medical care and the application of available preventive measures.

Two of the more common causes of poisoning by contact—poisonous plants and athlete's foot—will be discussed.

POISONING BY POISON IVY, POISON OAK, AND POISON SUMAC

These poisonous plants grow as vines or, in locations providing favorable soil and moisture, as shrubs waist to shoulder high. So-called poison ivy and poison oak are neither ivy nor oak but species of sumac. The poison emanates principally

from their leaves but also may be given off from bruising their roots, stems, and berries. The smoke from burning brush containing the plants has been known to carry the poisonous principle for some distance.

The symptoms appear on exposed skin surfaces, usually the hands, wrists, and arms, 6 hours to several days after exposure. There is a red rash with some swelling, itching, and burning followed by the formation of varying-size blisters filled with serum. The blisters may become pustular, and after breaking crusts or scabs are formed or considerable fluid may exude from the broken blisters. If the area affected is considerable and the inflammation severe, as in some cases, there may be fever, headache, and general body weakness. Some persons are much more susceptible to the poisonous plants than others, and when that fact is known they should avoid contact with them as much as possible.

Treatment.

When a person must work in brush where the poisonous plants may occur, the effects of contact may be prevented by previously coating hands and arms with a lather made from a strong laundry soap and permitting the lather to dry on the parts. Immediately after such work, wash the hands and arms with the soap and warm water, and again permit the lather to dry on the parts. A saturated solution of hyposulphite of soda in water may be used instead of the soap lather.

A 5-percent solution of ferric chloride in equal parts of water and alcohol or a solution of hyposulphite of soda, 1 tablespoon to a pint of water, applied four or five times a day usually dries the eruption. These solutions should be applied with cotton sponges and permitted to dry on the skin. Blisters may be opened with a sterile needle and the serum or pus absorbed on small pads of cotton. Be sure to apply one of the solutions to the part before the blisters are opened and immediately after to prevent spread of the disease.

Where the eruption persists, spreads, or is severe, medical attention should be obtained.

ATHLETE'S FOOT

Athlete's foot is a fungus disease of the skin similar to ringworm. There are several varieties of fungi known to cause the disease. The infection may occur on various parts of the body, but most frequently develops on the feet. The infection is contracted by coming in contact with some object that has been contaminated with the fungus from a pre-existing infection. Warmth and moisture are favorable conditions for the growth of the fungi; hence, most cases of athlete's foot occur among persons using swimming pools and shower baths. Wood slats, bath mats, and floor coverings contaminated by the fungus from a case of athlete's foot may spread the infection to many persons whose feet contact the fungus growth.

The symptoms of athlete's foot cover a wide range, depending on the length of time the infection has lasted without adequate treatment. The first symptoms are itching and burning of a small area on the soles of the feet but more particularly at the base of the toes or between the toes. The area becomes red and slightly swollen, and scales or crusts may form. Later blisters appear, and the infection spreads over a larger area. Raw surfaces with fissures or cracks that do not heal are noticed in cases of long standing. Secondary infections with pus formation are common in old cases.

Prevention.

The floors of shower booths in change houses should be scrubbed thoroughly with a strong alkali soap and hot water at least twice each week. Following the scrubbing the floor should be sprinkled with powdered sodium hyposulphite. It is advisable not to use wood-slat floors in shower booths; but if they are used, they should receive the same care given to the floors. At the entrance to the shower booth should be a shallow basin about 30 inches by 24 inches and 3 inches deep, so placed that those entering and leaving the booth will have to step into the basin. A solution of sodium hyposulphite, 1 pound to 8 gallons

of water, made fresh each day, should be kept in the basin. Those using the shower should be instructed to stand in the solution several seconds before entering and on leaving the shower. After passing through the foot bath on leaving the shower the hyposulphite solution should not be wiped from the feet but allowed to dry on them. Frequent changing and washing of both work and dress socks are further aids in preventing athlete's foot.

Treatment.

Change and wash socks frequently.

Soak feet for about 10 minutes morning and night in a solution of sodium hyposulphite made by dissolving 2 tablespoons of sodium hyposulphite in a quart of water. Permit the solution to dry on the feet. A 1-percent solution of sodium hypochlorite may be substituted for the sodium hyposulphite solution.

Dust the feet with a powder made of 1 part powdered sodium hyposulphite mixed with 4 parts powdered boric acid before putting on socks. The leather of inner soles of shoes affords a medium for the growth of the fungus causing athlete's foot, and reinfections often occur from the shoes where the dusting powder is not used regularly.

Where the infection is between the toes, they should be kept separated by pieces of absorbent cotton well-dusted with the above powder. The cotton should be changed daily and that taken out burned.

If the infection is extensive or does not respond to treatment, medical care should be obtained.

It should always be borne in mind that athlete's foot is easily transmitted, so care should be taken to protect other members of the family from the infection.

It is a good plan to continue treatment for a time after apparent cure, as isolated mild infections may be present that are unnoticed, and if treatment is stopped before they have been entirely cleared up they may become active.

FROSTBITE

Frostbite is the reaction of parts of the body exposed to severe cold. The nose, cheeks, ears, toes, and fingers are the parts most frequently frostbitten. The extent of tissue damage in frostbite is divided into degrees:

In first-degree frostbite the part is painful and the skin is dark red.

In second-degree frostbite the skin is bright red or blue, and blisters form on the surface.

In third-degree frostbite the part is stiff, pale, and brittle.

Severe cold causes constriction of the blood vessels, and death of the tissues results if the blood circulation is shut off completely for a considerable time.

Heat should never be applied immediately to a frostbite, but the temperature should be raised gradually to that of the body. If heat is applied to a first-degree frostbite, itching and tingling are experienced. If heat is applied to a second-degree frostbite, swelling and pain of the part result, and the skin may peel off, leaving a raw surface. If heat is applied to a third-degree frostbite, rapid thawing of the frozen tissues and vessels causes serious damage and may lead to gangrene. If the part is dead no reaction takes place, but the dead portion turns dark and a line can be seen separating the dead tissues from the living.

Treatment.

Do not rub the part frostbitten.

Do not expose the part to high temperatures immediately, but gradually increase the temperature to that of the body.

For first-degree frostbite cover the part with the hand while in a cool place, and gradually warm to body temperature when normal circulation is reestablished. If the part cannot be covered by the hands, cloths repeatedly wrung out in water should be placed over it. Start with cool water, not ice water, and gradually increase the temperature of the water, repeating applications of the cloths until body temperature is reached.

After the part has returned to normal color and the circulation has been reestablished the person may be taken into a heated room.

For a second-degree frostbite treat as for a first-degree frostbite, but raise the temperature of the water in which cloths are wrung out more gradually. Be gentle in applying the cloths so as not to tear away the skin. About 20 to 30 minutes is required for the treatment before the patient can enter a moderately heated room. On entering the room do not expose the part to direct heat, such as that near a stove or radiator.

For a third-degree frostbite treat as for a second-degree frostbite, but raise the temperature of the water in which cloths are wrung out even more gradually and move the patient first into a slightly heated room and then into only a moderately heated room. If the frostbite has caused tissue death a red line will be noted between the dark dead tissues and the live tissues.

All frostbites of the second and third degree should have medical care as promptly as possible.

FREEZING

When the entire body reacts to exposure to severe cold the individual becomes numb, exertion is difficult, the eyesight fails, he totters and falls, irresistible drowsiness overtakes him, and he becomes unconscious.

Treatment.

Procure medical attention as promptly as possible.

First place in a cool room, well wrapped in blankets, and if breathing has ceased apply artificial respiration. Rub the limbs under the blankets with a solution of equal parts of alcohol and tepid water. As the patient reacts, the temperature of the room should be raised gradually and the patient given hot drinks of coffee, tea, chocolate, or cocoa.

Efforts to revive a frozen person should be continued for several hours, as persons apparently dead have been restored to life after many hours of treatment.

EPILEPSY

Epilepsy or falling sickness is a nervous disease that causes convulsive attacks. The attacks may occur at regular intervals as frequently as once a day or irregularly with considerable time between them.

The patient usually is warned of an oncoming attack. He may be depressed or excited, and he often presents a marked apprehensive facial expression.

Symptoms.

The patient often cries out or screams and falls to the ground unconscious. His muscles stiffen, his head is drawn to one side by convulsive jerks, or there may be convulsive movements of the arms and legs. Breathing ceases for the moment and the face, at first pale, becomes blue. The patient may froth at the mouth. This stage lasts about a minute and is followed by breathing with a gradual return of normal color. The eyes, which are open, are rolled back and forth, and the teeth are clamped shut. The patient may bite his tongue or his cheeks and the froth at the mouth be blood-stained. The bladder and the bowels may move involuntarily. This second stage lasts several minutes, after which the patient slowly regains consciousness and feels very tired. Occasionally epileptic seizures are not recognized, and the patient is treated for some other condition or improperly handled.

Treatment.

Do not try to restrain the patient during convulsive movements, but see that he does not injure himself by falling into a fire or down a shaft or other opening.

Lay the patient on his back on a blanket with a pad under his head. Cover him and keep him warm.

Remove any foreign bodies from his mouth, and place a pad between his teeth to prevent biting his tongue or cheeks.

Loosen tight clothing at the neck and waist.

Give no stimulant or anything by mouth.

Keep the patient lying down at rest after he becomes conscious.

TRANSPORTATION OF INJURED

After receiving first-aid care a seriously injured person often requires transportation to a hospital, to a physician's office, or to his home. It is the responsibility of the first-aid man to see that transportation is made in such a manner as to prevent further injury, not to increase the severity of the original injuries, and that the patient is subjected to no unnecessary pain or discomfort. No matter how expert the first-aid care that has been given, improper handling and careless transportation often add to the severity of the original injuries, increase shock, and frequently endanger life.

Never move a patient until a thorough examination has been made and all injuries are protected by proper dressings. Seriously injured patients should be moved only in the lying position. If means for the proper transportation of an injured person are not immediately at hand, continue care of the patient to conserve his strength until adequate means of transportation can be procured.

Various carries that can be used in emergencies are described, but use of the stretcher is the preferred transportation method. Carrying in arms, carry astride back, and two-man carry should be used only when it is positively known that no injury will be complicated by such means of handling the patient.

ONE-MAN CARRY

ASSISTING TO WALK (ONE MAN)

The patient should put an uninjured arm over the bearer's shoulder and behind his neck. The bearer should grasp the

FIGURE 84.—Carrying in arms.

patient's hand and pass his other arm around the patient's waist. One bearer may thus support and assist a slightly injured person.

CARRYING IN ARMS

Support the patient with one arm about his body. Pass your other arm under his thighs. Roll the patient into the hollows of your elbows and carry. (See fig. 84.)

This method is easy for the patient but hard on the bearer and therefore can be used only when the patient is not too heavy or when it is not necessary to carry the patient far.

HOW ONE PERSON MAY MOVE AN INJURED OR UNCONSCIOUS PERSON

Place the injured person on his back; tie the ends of two cravat bandages together, making a loop; pass this over the person's head and down so that it will be under his back and around his sides at the armpits; next kneel, straddling the injured person, pass the loop over your head, and then, by crawling, you can drag him. (See fig. 85.) Occasionally this purpose is accomplished by tying the person's wrists together. The rescuer then passes his head between the arms. (See fig. 86.) Another method is to crawl with an injured person on your back, having first tied his wrists together and passed your head through the loop formed by his arms. When a place is reached where the bearer can stand erect, carrying astride of back as described below is often a convenient method, if further one-man transportation seems advisable.

CARRYING ASTRIDE BACK

To carry a patient astride the back, assist him to an erect position. Then shift quickly to the front of the patient, your

FIGURE 85.—Moving or dragging patient; use of cravat bandage.

FIGURE 86.—Moving or dragging patient; patient's wrists tied together.

back toward him. Bend forward until he rests upon your back, with his arms over your shoulders and his forearm crossed on your chest. Now grasp each of his thighs, and by a humping motion raise him to a position well up on your back. Pass your forearms under each thigh, and grasp one of his wrists in each of your hands. (See fig. 87.)

TWO-MAN CARRY

ASSISTING TO WALK (TWO MEN)

The patient should put one arm over the shoulder and behind the neck of each bearer, and his hand should be grasped by each bearer. The bearers pass their arms around the patient's waist, thus giving him added support. (See fig. 88.)

TWO-HANDED SEAT CARRY

The bearers kneel on each side of the injured person, near his hips, and raise him to a sitting position. Each then passes one arm around the patient's back and the other under his thighs, the bearer on the patient's right grasping with his right hand the left wrist of his companion, the bearer on the left grasping with his left hand the right wrist of the first bearer. Both rise slowly from the ground and lift their disengaged hands to each other's shoulders, thus forming a back rest for the patient; or, unless the patient is helpless, he may support himself by placing an arm around the neck of each bearer. (See figs. 89 and 90.)

CARRYING BY EXTREMITIES

Still another method that requires no effort by the patient but is not applicable to severe injuries of the limbs is carrying by the extremities. For this carry, one bearer takes a position between the patient's legs and the other at his head, both facing toward his feet. The rear bearer raises the patient to a sitting

FIGURE 87.—Carrying astride back.

768735 O—48——17

FIGURE 88.—Two-man : Assisting to walk.

FIGURE 89.—Two-handed seat carry : Position of bearers' hands and arms.

FIGURE 90.—Two-handed seat carry : Carrying patient.

position and clasps him from behind around the body under the arms, while the front bearer, standing between the legs, passes his hands from the outside under the bent knees. Both rise together. (See figs. 91 and 92.)

THREE-MAN LIFT AND CARRY

This lift is the same as the full-squad lift described on page 257 and must be done at the command of the captain or one of the bearers, usually the one at the patient's head.

"*Prepare to lift—patient.*" Each of the three men kneels on the knee nearest the patient's feet, one opposite the patient's shoulders, another opposite his hips, and the third opposite his knees. Unless the nature of the patient's injuries makes it undesirable, the bearers kneel by his uninjured or least injured side. (See fig. 93.) They pass their hands and forearms under the patient (for details, see description under Stretcher Drill, p. 257) and at the command, "*Lift—patient,*" slowly raise the patient and support him on their knees. (See fig. 94.) At the command, "*Prepare to rise with—patient,*" the bearers slowly turn the patient onto his side so that he rests in the bend of their elbows and is held closely to their chests. When the command, "*Rise with—patient,*" is given, all rise slowly. The bearers can now, when commanded, step off in any direction with the patient. (See fig. 95.) The principal use for this method is in very narrow places. The bearers sidestep when so commanded, "*Sidestep left (or right)—march.*" The bearers step off with the foot corresponding to the direction of command, bringing the heels together at each second step. The steps should be short and made slowly. In actual cases any well-understood commands may be used.

FIGURE 91.—Preparing to lift patient in carrying by extremities.

FIGURE 92.—Carrying patient by extremities

FIGURE 93.—Three-man carry: Preparing to lift patient.

FIGURE 94.—Three-man carry: Patient resting on bearers' knees.

FIGURE 95.—Three-man carry : Patient in position to carry.

STRETCHERS

The ordinary stretcher, known as the Army stretcher, consists of two long poles with a bed, usually made of canvas, between them and crosspieces to keep the long poles apart and thus stretch the canvas. The poles are long enough to afford hand holds for the bearers at each end of the stretcher. (See fig. 96.)

The Stokes Navy stretcher is a woven wire basket made to conform to the human body. The patient, after having been strapped to the basket, may be placed in a vertical position and carried on a mine cage or skip. This type of stretcher is used almost exclusively in metal mines or in coal mines where the coal bed has a steep pitch. (See fig. 97.)

Satisfactory stretchers may be improvised—that is, they may be put together on the ground with the materials at hand. A good stretcher may be made from three or four coats or jackets. These are turned inside out, and two poles are passed through the sleeves. The flaps are then turned down around the poles and buttoned underneath. (See figs. 98 and 99.)

A stretcher may be improvised from a blanket, a piece of canvas, or brattice cloth of similar size by placing one pole on the unfolded material about 1 foot from its center. Fold the short side of the material over the pole toward the other side; place the second pole on the two thicknesses about 2 feet from the other pole; and fold the remaining side of the material over the second pole toward the first pole. By this method, when the injured person is placed on the blanket the folds are locked by the friction exerted by the weight of the body. (See fig. 100.)

Bags or sacks may be used for stretcher beds. The bottoms of the bags or sacks should be ripped so that the poles may be passed through them and an adequate number should be used to give the length of bed required.

Various types of splint stretchers are also used (figs. 101–104). These are prepared splints to which a patient can be strapped and the splint then used as a stretcher.

FIGURE 96.—Army stretcher.

FIGURE 97.—Stokes Navy stretcher.

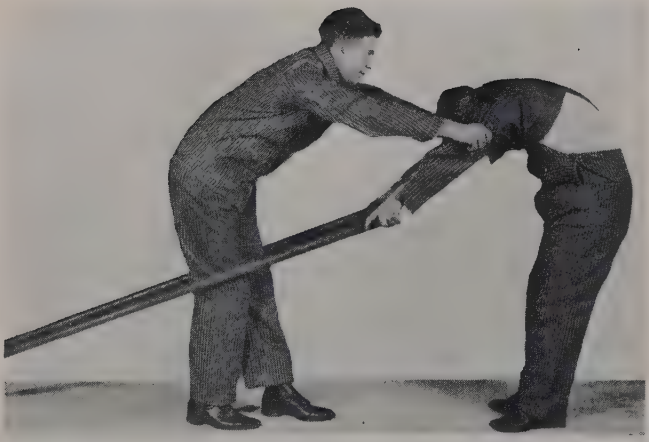

FIGURE 98.—Making improvised stretcher from coats or jackets.

STRETCHER TRANSPORTATION

A stretcher should always be tested before a patient is placed on it. To test a stretcher, place an uninjured man, weighing as much or more than the patient, on the stretcher and lift it. Great care must always be taken in placing an injured person on a stretcher, otherwise the patient will be subjected to unnecessary pain. The bearers should work together on command of the captain or of the man in charge. Whenever possible, a mine car should be used in transporting the injured out of a mine, the stretcher being either fastened or

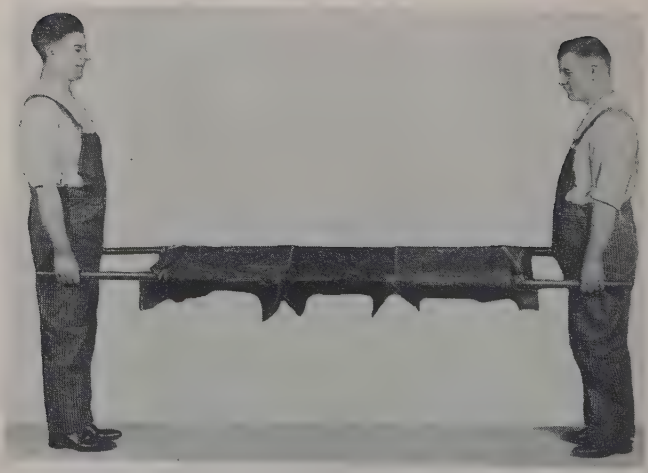

FIGURE 99.—Improvised stretcher from coats or jackets completed

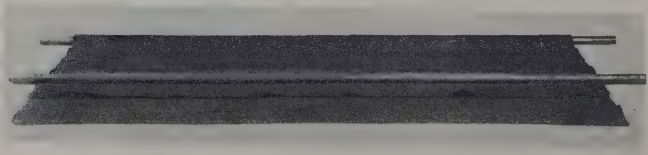

FIGURE 100.—Improvised blanket stretcher, partly folded.

FIGURE 101.—Bureau of Mines general utility splint stretcher.

FIGURE 102.—Home stake splint stretcher.

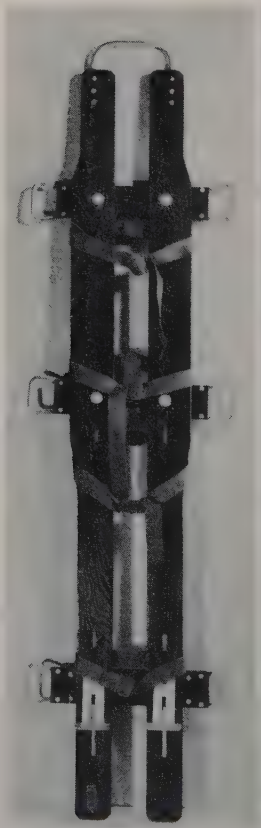

FIGURE 103.—Jarrett splint stretcher.

FIGURE 104. Portable splint stretcher.

held in the car to prevent unnecessary jarring of the patient. The car should be taken out alone and not with a loaded trip, and such a car should always have the right-of-way. No matter how well trained the men are who have charge of the injured, it is impossible to carry an injured man along the roadbed in a mine without irregular stepping and jolting. Some of the companies have met this problem of transportation of the injured out of mines in an efficient way by providing special ambulance tramcars. It is hoped that this method may soon become universal. In handling an injured man, with or without a stretcher, the bearers should move together and as gently and steadily as possible. In some instances where patients are to be transported by stretcher it is advisable to fold the arms across the chest and tie them together, as described on page 167. When necessary the feet also may be tied together during transportation.

STRETCHER DRILL

The stretcher squad consists of five men, one of whom will be the captain. The captain should direct and supervise all work of the first-aid men. After determining the various injuries and their severity, the captain should assign every man to his duty and he himself should assist in the work. His words of command, as outlined below, should be obeyed promptly.

The stretcher drill described below is recommended for use in first-aid contests. (See figs. 105 to 113.)

The captain should give all commands in a military manner; that is, he should give first a preparatory command to place each man in readiness and follow this command after a definite interval of 1 or 2 seconds by the final command. With this method the movements can easily be made in unison, and consequently more satisfactorily and efficiently. The dash (—) in the command as given represents the interval between the preparatory and the final command.

CAPTAIN. "*Fall in.*"

768735 O—48——18

FIGURE 105.—Crew in line for stretcher drill, No. 3 having obtained the stretcher.

The four men fall in line, standing side by side, each with head erect, hands at sides, heels together, and eyes straight ahead. When each man stands at attention in this manner the squad makes a fine appearance, but if one man has his feet apart and another his heels together, and one has his hand behind his back and another keeps his hands at his sides, the squad does not make a good impression on either judges or spectators. (See fig. 105.)

CAPTAIN. "*Count off.*"

The man at the right of the squad (looking toward patient) calls, "*One,*" and the remainder of the squad follow in order, counting "*Two,*" "*Three,*" "*Four.*"

CAPTAIN: "*Procure stretcher—march.*"

At the command "*March,*" No. 3 steps forward and proceeds to the stretcher by the shortest route, picks it up, and places it over his right shoulder and returns to his place in line, as shown in figure 105.

CAPTAIN. "*Carry stretcher—march.*"

At the command "*March,*" No. 3 tilts the stretcher on his shoulder and, holding one end, allows the other end of the stretcher to fall slowly forward. At the same time No. 2 takes two long paces to the front, and as the stretcher drops forward he catches the handles at the free end with his left hand. No. 1 steps to the middle of the right side of the stretcher, and No. 4 steps to the middle of the left side. (See fig. 106.)

CAPTAIN. "*To patient, forward—march.*"

After reaching the patient, Nos. 2 and 3 open the stretcher and fix the braces.

CAPTAIN. "*Test stretcher.*"

Nos. 2 and 3 grasp the stretcher by the handles facing each other and No. 1 or No. 4, whoever is the heavier, takes his place on the stretcher and is raised 3 feet from the ground to test the stretcher.

CAPTAIN. "*Post to patient's right (or left)—march.*"

No. 3 takes his position on the side indicated opposite the patient's head, No. 1 opposite the patient's hips, No. 2 opposite the patient's ankles, and No. 4 on the other side of the patient opposite the hips. In placing the patient on the stretcher the lift is made with three men on the uninjured or least injured side unless the nature of the patient's injuries makes it advisable to have three men on the injured or more severely injured side.

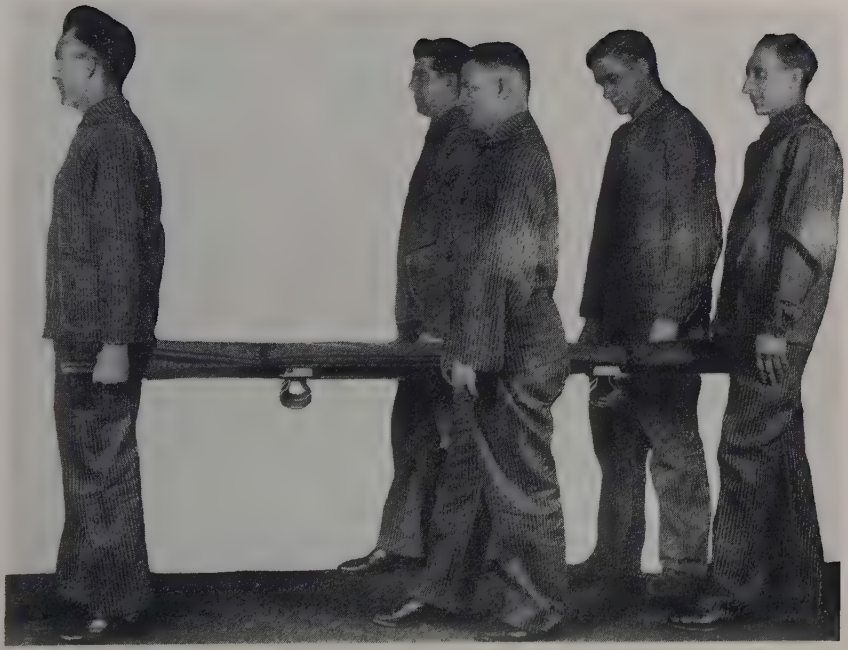

FIGURE 106.—Stretcher drill: Carrying stretcher.

CAPTAIN. "*Prepare to lift—patient.*"

Each of the four men kneels, No. 2 opposite the patient's knees, No. 3 opposite the patient's shoulders, and Nos. 1 and 4 opposite the patient's hips on their respective sides. Each of the three men kneels on the knee nearest the patient's feet. No. 3 places his hands under the patient's neck and shoulders, No. 2 places his hands under the patient's knees and ankles, while Nos. 1 and 4 place their hands under the patient's pelvis and the small of his back. (See fig. 107.)

CAPTAIN. "*Lift—patient.*"

The patient is slowly raised and supported on the knees of the three men, and the other man places the stretcher under the patient. (See fig. 108.) In injuries to the back or pelvis lift the patient just high enough for the captain to slide the body splint or splint stretcher under the patient, and not to the knees of the kneeling men.

CAPTAIN. "*Prepare to lower—patient.*"

The man who has placed the stretcher kneels and places his hands in position to support the patient.

CAPTAIN. "*Lower—patient.*"

The patient is gently lowered to the stretcher, as shown in figure 109.

CAPTAIN. "*Post to carry stretcher—march.*"

No. 3 takes his place at the rear end of the stretcher. The patient is carried on the stretcher feet first, the end nearest his feet being the front and the end nearest his head the rear; No. 2 takes his position at the front end, and Nos. 1 and 4 stand on either side. Nos. 2 and 3 face each other, and Nos. 1 and 4 face each other.

CAPTAIN. "*Prepare to lift—stretcher.*"

All stoop and grasp the stretcher, Nos. 2 and 3 by the handles and Nos. 1 and 4 at the sides.

CAPTAIN. "*Lift—stretcher.*"

The stretcher is gently and slowly raised. Nos. 1 and 4 shift one hand toward the front of the stretcher and support this

FIGURE 107.—Stretcher drill: Preparing to lift patient.

FIGURE 108.—Stretcher drill: Patient resting on bearers' knees; stretcher placed in position.

FIGURE 109.—Stretcher drill : Lowering patient.

end, while No. 2 turns to the marching position. If the patient is suffering from severe bleeding of the head and must be carried up a steep grade on a stretcher, his head should be carried first, with No. 3 bearer leading. (See figs. 110 and 111.)

CAPTAIN. "*Forward—march.*"

Nos. 1, 2, and 4 step off with the left foot, whereas No. 3 steps off with his right foot. This procedure prevents the stretcher from swaying.

In marching, when necessary to turn:

CAPTAIN. "*Squad right (or left)—march.*"

In marching, when it is necessary to turn completely around or when an ambulance is approached from the rear:

CAPTAIN. "*Squad right about (or left about)—march.*"

The squad makes a complete half turn about (180°) to the right or left.

CAPTAIN. "*Squad—halt.*"

At the command "Halt" each man takes an additional step forward and then brings the foot in the rear up to a heel-to-heel position with the foot that is forward.

CAPTAIN. "*Prepare to lower—stretcher.*"

Nos. 1 and 4 shift one hand toward the front of the stretcher and support this end, while No. 2 turns around, facing No. 3. Nos. 1 and 4 take position facing each other.

CAPTAIN. "*Lower—stretcher.*"

The stretcher is then gently and slowly lowered.

CAPTAIN. "*Post to load ambulance—march.*"

The captain opens the ambulance door and takes his place in the ambulance. The patient is put in the ambulance head first. (See fig. 112.)

No. 3 steps to the right side of the stretcher, opposite the patient's head; No. 2 to the left side of the stretcher, opposite the patient's feet; No. 1 moves toward the patient's feet on his side and No. 4 toward the patient's head on his side, so that Nos. 1 and 2 face each other, and Nos. 3 and 4 also face each other.

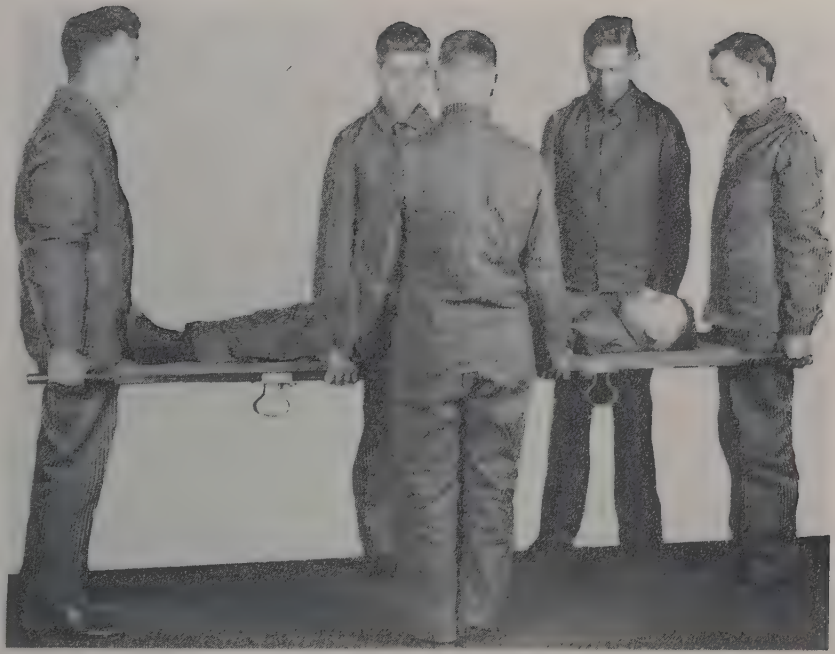

FIGURE 110.—Stretcher drill: Lifting stretcher.

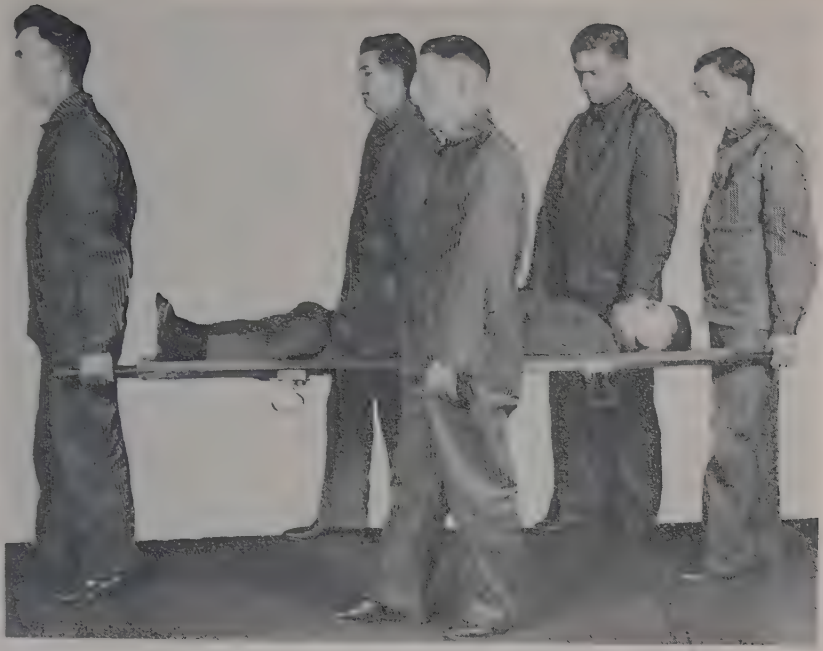

FIGURE 111.—Stretcher drill: Carrying patient.

CAPTAIN. *"Prepare to lift—stretcher."*

All four stoop and grasp the stretcher with arms outstretched, supporting the ends, and the middle of the stretcher.

CAPTAIN. *"Load—ambulance."*

All rise to an erect position and sidestep to the ambulance. The front men place their end of the stretcher on the ambulance floor and step to the side, and the rear men push the stretcher forward into position in the ambulance.

The captain carefully guides the stretcher into position.

If in marching with a loaded stretcher it becomes necessary to cross an obstacle:

CAPTAIN. *"Squad—halt."*

"Prepare to cross—obstacle."

Nos. 1 and 4 grasp the handles with their free hands, relieving No. 2, so that he can cross the obstacle.

CAPTAIN. *"Cross obstacle—march."*

Nos. 1, 4, and 3 then advance the stretcher over the obstacle to a point where No. 2, who has crossed to the other side, can grasp and support the handles at the front end. Nos. 1 and 4 then cross the obstacle and again obtain side holds on the stretcher, relieving No. 3 and carrying the stretcher forward with the assistance of No. 2. No. 3 then crosses the obstacle and takes his normal position.

Because of low or narrow places and numerous obstructions a patient sometimes cannot be carried on a stretcher within a mine or other low or narrow places according to the directions outlined above; therefore, the following method has been adopted:

To transport an injured person on a stretcher of the Army type in a mine the stretcher bearers should be in a position to see where they step. For carrying a patient underground each of the four stretcher bearers should take hold of a handle of the stretcher. The free hand may be used for carrying a light or for support along the side of passageways. The captain should precede and select the route, Nos. 2 and 4 taking lead handles and Nos. 1 and 3 the rear handles of the stretcher.

Figure 113 is a diagram of standardized stretcher drill.

FIGURE 112.—Stretcher drill : Post to load ambulance.

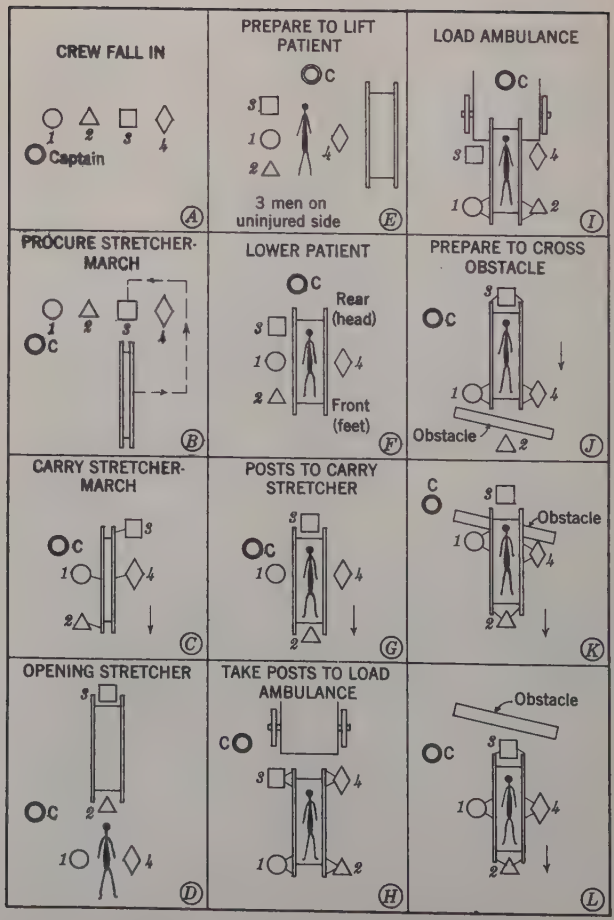

FIGURE 113.—Diagram of stretcher drill.

APPENDIX

WHAT A FIRST-AID MAN SHOULD DO

Send for medical aid in all serious injuries.

Have all supposed minor injuries checked by a physician to be sure they have been cared for properly.

Be calm.

Take command and give orders.

Locate the injury.

Know what he wants to do and do it.

Keep onlookers away from the patient.

If artificial respiration is indicated start it without delay.

Use a knife or scissors to remove clothing.

Look for bleeding, and check it by pressure of the fingers or thumb on the skin over the blood vessel at the location of the pressure point, by a tourniquet, or by a bandage compress and bandage applied with pressure over the wound.

Look for physical shock, and if it is present treat it immediately.

Keep the patient lying down.

Cover all wounds completely with a *sterile* bandage compress and a triangular or cravat bandage, except wounds of the eye, nose, chin, fingers, or toes, where a bandage compress only is used.

Do not allow the fingers or instruments to touch a wound.

Remove a loose foreign object from a wound with a piece of sterile gauze, but do not attempt its removal if it is embedded in the wound.

Look for fractures; never move a patient, unless absolutely necessary, until splints have been applied.

Leave reductions of dislocations or fractures for a surgeon, except dislocation of jaw, fingers, or toes.

Place a bandage compress and a bandage without undue pressure over a compound fracture before applying splints.

Exclude air as quickly as possible from burned surfaces by using picric-acid gauze or other suitable dressing.

Remember that only part of your work is completed when the patient is ready for the stretcher. Unnecessary or rough handling of a patient may undo all your work.

Place the patient on the stretcher carefully, avoiding jerky movements, and carry him to safety. Always test a stretcher before placing patient on it.

If you have to turn over to some other person a patient with a tourniquet applied, be sure to advise him of the location of the tourniquet and the length of time it has been tight.

DONT'S FOR A FIRST-AID MAN

Don't fail to send for medical aid in serious injuries.

Don't delay where artificial respiration is needed.

Don't fail to hold the tongue forward when using the Sylvester method of artificial respiration.

Don't fail to remove false teeth, tobacco, or other foreign objects from the mouth of an unconscious person.

Don't touch a wound with your fingers or anything that is not sterile.

Don't put an unclean dressing or cloth over a wound.

Don't allow bleeding to go unchecked.

Don't neglect shock.

Don't move a patient unnecessarily.

Don't allow a patient with a fracture or suspected fracture to be moved until splints have been applied.

Don't fail to put plenty of padding between limb and splint.

Don't make a severely injured person sit up, stand, or walk.

Don't burn a patient with an unwrapped hot-water bottle or other heated object.

Don't remove the clothing from the injury in the usual way—cut or rip, at seams when possible.

Don't permit air to reach a burned surface.

Don't wash wounds.

Don't put drugs in or on a wound.

Don't remove a foreign object that is embedded in a wound.

Don't attempt to reduce dislocations, except of the fingers, toes, or lower jaw.

Don't put a quid of tobacco on a wound.

Don't leave a tourniquet on longer than 10 minutes without loosening.

Don't tie knots over the eye.

Don't tie knots over wounds of skull when fracture is suspected.

Don't tie knots over protruding bones in compound fracture.

Don't fail to test a stretcher before placing a patient on it.

Don't fail to send your patient to a physician in minor injuries.

FIRST-AID INSTRUCTOR'S SIX FUNDAMENTALS OF FIRST AID

1. Artificial respiration:

(*a*) Conditions requiring artificial respiration.
(*b*) Preparation of the patient.
(*c*) Methods:
  (1) Schaefer or prone method.
  (2) Sylvester method.
(*d*) Rhythm.
(*e*) Length of time artificial respiration should be continued.

2. Control of bleeding:

(*a*) Three kinds of bleeding:
  (1) Arterial.
  (2) Venous.
  (3) Capillary.

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(*b*) Five methods of control:
  (1) Digital pressure.
  (2) Tourniquet.
  (3) Direct pressure.
  (4) Elevation.
  (5) Cold applications.
(*c*) Pressure points—locations.
(*d*) Length of time a tourniquet may remain tight.
(*e*) Amount of blood in the body and how much may be lost without endangering life.

3. Treatment for shock:

(*a*) Causes.
(*b*) Effect—symptoms.
(*c*) Treatment:
  (1) Preparation of patient.
  (2) Position of patient.
  (3) Wrapping patient.
  (4) Use of heated objects—precautions.
  (5) Use of stimulants.
  (6) Rubbing extremities.
(*d*) Difference in treatment for shock:
  (1) Fractured skull and apoplexy.
  (2) Sunstroke.
  (3) Internal bleeding.

4. Caring for open wounds and burns:

(*a*) Open wounds:
  (1) Four kinds of open wounds:
    (*aa*) Abraded.
    (*bb*) Incised.
    (*cc*) Lacerated.
    (*dd*) Punctured.
  (2) Precautions in dressing:
    (*aa*) Removal of clothing.
    (*bb*) Do not touch with anything not sterile.
    (*cc*) Do not wash.

(3) Infection:
(*aa*) Cause.
(*bb*) Prevention.
(4) Treatment:
(*aa*) Control of bleeding.
(*bb*) Sterile dressings.
(*cc*) Cover bandages.
(*dd*) Treat for shock.

(*b*) Burns:
(1) Causes:
(*aa*) Dry heat.
(*bb*) Moist heat.
(*cc*) Chemicals.
(2) Treatment:
(*aa*) Removal of clothing.
(*bb*) Danger of infection.
(*cc*) Use of picric-acid gauze.
(*dd*) Use of tannic acid.
(*ee*) Avoid grease or oil—use water-soluble ointments.
(*ff*) Chemical burns to be washed with clean water.
(*gg*) Avoid tight bandages.
(*hh*) Treat for shock.

5. Treatment for dislocations and fractures:

(*a*) Dislocations:
(1) Symptoms:
(*aa*) Occur only at joints.
(*bb*) Pain.
(*cc*) Deformity.
(*dd*) Inability to use joint.

(2) Treatment:
(*aa*) Reduced in first aid—lower jaw, finger, or toe.
(*bb*) Dress in line of deformity.
(*cc*) Danger of attempting to reduce major dislocations.
(*dd*) Treat for shock.

(*b*) Fractures:
(1) Two kinds:
(*aa*) Simple.
(*bb*) Compound.
(2) Symptoms:
(*aa*) Deformity.
(*bb*) Swelling.
(*cc*) Pain.
(*dd*) Loss of normal use.
(3) Treatment:
(*aa*) Care in movement to prevent converting simple into compound fracture.
(*bb*) Support.
(*cc*) Control of bleeding in compound fracture.
(*dd*) Tourniquet in compound fracture.
(*ee*) Dress wound in compound fracture.
(*ff*) Pad splints well.
(*gg*) Arch for tourniquet and wounds in compound fracture.
(*hh*) Support with splints and bandages.
(*ii*) Treat for shock.

6. Transportation:

(*a*) Precautions in moving an injured person.
(*b*) One-, two-, and three-man carries.
(*c*) Types of stretchers:
(1) Army.
(2) Stokes Navy.
(3) Improvised.
(4) Splint stretchers.

(*d*) Stretcher drill:
(1) Fall in.
(2) Count off.
(3) Procure stretcher.
(4) Carry stretcher.
(5) Test stretcher.
(6) Load stretcher.
(7) Carry patient.
(8) Unload stretcher.

NOTE.—These fundamentals are given in the order of importance and may be used to advantage by Bureau instructors and cooperative instructors in instructing and quizzing classes. Classes should be well-grounded in these fundamentals as an aid for them in what to look for and the most important thing to do in an actual injury. In addition to the above, the following subjects should be explained by the instructor and discussed by the class:

1. Anatomy of human body:
   (*a*) Skeleton.
   (*b*) Joints.
   (*c*) Muscles and tendons.
   (*d*) Skin.
   (*e*) Chest cavity and contents.
   (*f*) Abdominal cavity and contents.
   (*g*) Air passages, lungs, and diaphragm.
   (*h*) Heart.
2. Fainting.
3. Heat exhaustion.
4. Heat cramps.
5. Sunstroke.
6. Apoplexy.
7. Bruises.
8. Strains.
9. Sprains.

10. Hernia.
11. Foreign bodies in eye, ear, nose, throat, and stomach.
12. Poisoning:
    (*a*) By mouth—corrosive, irritant, systemic.
    (*b*) Breathed in with air.
    (*c*) Injected into skin—bites of rabid animals, bites of poisonous snakes, and bites and stings of insects
    (*d*) Contact—poisonous plants and athlete's foot
13. Frostbite.
14. Freezing.
15. Epilepsy.

QUESTIONS AND ANSWERS ON FIRST-AID TRAINING

ANATOMY

1. Q. *Into what three parts is the body divided for first aid?*
   A. The body is divided into the head, the trunk, and the extremities (p. 31).
2. Q. *Approximately how many bones compose the adult human skeleton?*
   A. Approximtely 200 bones (p. 31).
3. Q. *What is the skeleton?*
   A. The skeleton is the strong flexible framework of the body (p. 31).
4. Q. *What is the purpose of the skeleton?*
   A. To support and carry the soft parts, protect vital organs from injury, and give attachment to the muscles (p. 31).
5. Q. *What is the skull and what does it protect?*
   A. The skull is a bony case enclosing and protecting the brain (p. 33).
6. Q. *What bones form the trunk?*
   A. The spinal column, the ribs, the breastbone, and the pelvis (p. 34).

7. Q. *What is the spinal column and what does it protect?*
   A. A flexible column composed of segments called vertebrae held together by strong ligaments; it encloses and protects the spinal cord (p. 34).
8. Q. *How many ribs are on each side of the chest?*
   A. There are 12 ribs on each side of the chest (p. 34).
9. Q. *What is the pelvis?*
   A. A basin-shaped bony structure at the lower portion of the trunk (p. 34).
10. Q. *What comprises the upper extremity?*
    A. The collarbone, shoulder blade, arm, forearm, wrist, and hand (p. 35).
11. Q. *How many bones are in the arm?*
    A. There is one bone in the arm (p. 35).
12. Q. *How many bones are in the forearm?*
    A. There are two bones in the forearm (p. 35).
13. Q. *What comprises the lower extremity?*
    A. The thigh, kneecap, leg, ankle, and foot (p. 35).
14. Q. *How many bones are in the thigh?*
    A. There is one bone in the thigh (p. 35).
15. Q. *How many bones are in the leg?*
    A. There are two bones in the leg (p. 35).
16. Q. *What is a joint?*
    A. Where two or more bones come together and there is movement (p. 35).
17. Q. *How are the bones forming a joint held in position?*
    A. By strong ligaments and bands of fibrous tissue (p. 35).
18. Q. *What are muscles, and what is their function?*
    A. Fleshy fibers; they give shape to the body and, by lengthening and shortening their fibers, cause movements of the parts to which they are attached (p. 37).
19. Q. *What are tendons?*
    A. Strong, fibrous cords by which muscles are attached to bones (p. 37).

20. Q. *What is the skin, and what are some of its functions?*
    A. The skin is the protective covering of the body, and in it are special organs, the sense of touch, and the glands that assist in getting rid of body heat and certain impurities (p. 37).
21. Q. *What divides the trunk into two parts?*
    A. A strong muscular partition called the diaphragm (p. 37).
22. Q. *What is the upper portion of the trunk called?*
    A. The chest cavity (p. 37).
23. Q. *What are the contents of the chest cavity?*
    A. The heart, lungs, gullet or foodpipe, windpipe, and several large blood vessels (p. 38).
24. Q. *What is the lower portion of the trunk called?*
    A. The abdominal cavity (p. 39).
25. Q. *What are the contents of the abdominal cavity?*
    A. The liver, stomach, spleen, pancreas, small intestine, large intestine, bladder, and several large blood vessels (p. 39).
26. Q. *What are the principal excretory systems?*
    A. The bowels, kidneys, lungs, and sweat glands (p. 39).

FIRST-AID DRESSINGS

27. Q. *What dressings are used in first aid?*
    A. Bandages, sterile bandage compresses, sterile gauze, picric-acid gauze, splints, and tourniquets (p. 40).
28. Q. *What two types of bandages are used to cover wound dressings and burn dressings in first aid?*
    A. Triangular bandages and cravat bandages (p. 40).
29. Q. *What is a cravat bandage?*
    A. A cravat bandage is a triangular bandage folded to form a wide cravat bandage, a medium cravat bandage, or a narrow cravat bandage (p. 42).
30. Q. *What kind of a knot is used in tying first-aid dressings?*
    A. A reef or square knot is used exclusively in tying dressings in first aid (p. 42).

31. Q. *Describe a sterile bandage compress.*
A. A sterile bandage compress consists of a number of layers of sterile gauze sewed to a strip of muslin, and so folded that the dressing can be applied to the wound without contamination (p. 42).

32. Q. *How should sterile gauze and picric-acid gauze be handled in applying to wounds and burns?*
A. The gauze should be handled so that the portion applied to the wound or burn is not contaminated by touching anything else (p. 44).

33. Q. *How many types of slings are used in first aid, and what are they called?*
A. Two types of slings are used in first aid—the triangular bandage sling and the cravat bandage sling (p. 46).

34. Q. *What is a tourniquet?*
A. A tourniquet is an appliance used to check bleeding from an artery by pressure on the artery against a structure beneath the artery, usually against a bone (p. 48).

35. Q. *Name some materials that may be used in making an improvised tourniquet?*
A. A triangular bandage, a strap, a handkerchief, a necktie, a belt, suspenders, a piece of brattice cloth, or a piece of rubber tubing (p. 48).

36. Q. *What materials should not be used in making an improvised tourniquet?*
A. Wire, cord, or anything that will cut into the flesh should never be used in making an improvised tourniquet (p. 48).

RESPIRATION

37. Q. *What is respiration?*
A. Respiration is breathing by which air is taken into the lungs during inspiration and forced out of the lungs during expiration (p. 48).

38. Q. *What are the air passages through which the air passes in reaching the lungs?*
    A. The nose, throat, and windpipe (p. 48).
39. Q. *What is at the top of the windpipe to prevent food or liquid entering the windpipe when being swallowed?*
    A. A flap known as the epiglottis is at the top of the windpipe and closes over the windpipe during the act of swallowing to prevent food or liquid from entering it (p. 48).
40. Q. *If an unconscious person is lying on his back, what may happen to the tongue or the epiglottis to prevent air from reaching the windpipe?*
    A. Often when a person is unconscious and lying on his back, the tongue falls back into the throat and prevents the epiglottis from opening (p. 48).
41. Q. *What should be done with the tongue of an unconscious person when breathing is embarrassed or absent?*
    A. It should be drawn forward and held in that position so as not to interfere with the opening into the windpipe (p. 49).
42. Q. *How does the windpipe divide and what are the divisions called?*
    A. The windpipe extends into the chest cavity, divides into the bronchi, and subdivides into many branches known as bronchial tubes (p. 49).
43. Q. *What are the lungs?*
    A. The lungs are two soft, spongy, and elastic cone-shaped bodies (p. 50).
44. Q. *How do the bronchial tubes terminate in the lungs?*
    A. After subdividing into many small branches, the bronchial tubes end in a group of air cells that resemble a bunch of grapes, except that they are many times smaller (p. 50).
45. Q. *Describe the walls of the air cells and their relation to the blood vessels in the lungs.*

A. The walls of the air cells are very thin, and around them is a fine network of small blood vessels or capillaries (p. 50).

46. Q. *Explain the circulation of the blood in the lungs and the exchange of waste products for a fresh oxygen supply.*

A. The blood in the capillaries surrounding the air cells gives up carbon dioxide and other waste matter brought from all over the body through the thin air-cell walls and in exchange takes on a supply of oxygen from the air breathed in (p. 50).

47. Q. *What happens to the carbon dioxide and waste matter that pass into the air cells?*

A. The carbon dioxide and waste matter passing from the blood into the air cells in exchange for oxygen are breathed out through the expired air (p. 50).

48. Q. *What is the normal breathing rate of an adult at rest?*

A. An adult at rest breathes 15 times per minute (p. 50).

49. Q. *What is the amount of air breathed by an adult per respiration at rest?*

A. 25 to 30 cubic inches of air per respiration (p. 50).

50. Q. *What may cause an increase in the breathing rate per minute and the volume of air entering the lungs at each respiration?*

A. Exercise or labor will increase both the number of respirations per minute and the volume of air drawn into the lungs at each respiration (p. 50).

51. Q. *What happens during the act of inspiration?*

A. The chest cavity enlarges by the separation of the ribs, and the diaphragm lowers, thus drawing in air (p. 51).

52. Q. *What happens during the act of expiration?*

A. The chest cavity decreases by the ribs closing and the diaphragm rising. Thus the air is expelled (p. 52).

53. Q. *What is the relation of oxygen to tissue life?*
A. All living tissues of the body depend for life on the oxygen carried by the blood, and any interference with breathing reducing the fresh oxygen supply to the blood produces a condition of oxygen want, or tissue asphyxia, throughout the body (p. 52).

ARTIFICIAL RESPIRATION

54. Q. *What is the first fundamental of first aid?*
A. Artificial respiration (p. 52).
55. Q. *What is artificial respiration?*
A. A method by which normal respiration is imitated by manual movements to restore breathing (p. 52).
56. Q. *How is artificial respiration accomplished?*
A. As we have no means of influencing muscular action in an unconscious person to produce normal respiration, we depend on manual means of forcing air from the lungs by compression and depend on the tonus and natural elasticity of the walls of the chest cavity, plus the drop of the arch of the diaphragm, to draw fresh air into the lungs when the compression is released (p. 52).
57. Q. *What are some of the conditions in which artificial respiration is required?*
A. Electric shock, gas poisoning, drowning, and suffocation from various causes (p. 52).
58. Q. *How many lives are estimated to be saved each year by artificial respiration, with the use of the oxygen inhaler?*
A. Between 40,000 and 50,000 lives are thought to be saved each year by artificial respiration, and artificial respiration with the use of the oxygen inhaler (p. 52).
59. Q. *When artificial respiration is neccessary, how soon should it be started?*

A. It should be started at once if the patient is at a point free from danger; otherwise, as soon as the patient has been moved to a safe place (p. 53).

60. Q. *How long should artificial respiration be continued?*
A. Until natural breathing has been restored or until a physician declares the patient dead (p. 53).

61. Q. *How long has artificial respiration been given and the patients resuscitated?*
A. Patients have been resuscitated after artificial respiration has been given as long as 72 hours (p. 53).

62. Q. *How should the patient be prepared for artificial respiration?*
A. All foreign bodies should be removed from the mouth; the tongue should be pulled forward; and tight clothing at the neck, chest, and waist should be loosened (p. 53).

63. Q. *Should physical shock treatment be given during artificial respiration?*
A. Physical shock treatment should be given throughout artificial respiration (p. 53).

64. Q. *What stimulant should be given during artificial respiration, and by what means?*
A. Aromatic spirits of ammonia should be given by inhalation (p. 53).

65. Q. *What two methods of artificial respiration are used in first aid?*
A. The Schaefer or prone-pressure method and the Sylvester method (p. 53).

66. Q. *Which of the two methods of artificial respiration is preferable, and why?*
A. The Schaefer method of artificial respiration is preferable because it is simpler and easier to perform (p. 53).

67. Q. *Describe the position of the patient in the Schaefer method of artificial respiration.*

A. In the Schaefer method of artificial respiration, lay the patient on his belly, one arm extended directly over his head, the other bent at the elbow, and turn the head toward the extended arm so that the side of the face will rest on the hand or forearm of the bent arm (p. 54).

63. Q. *Describe the position of the operator at start of Schaefer method of artificial respiration.*

A. Operator should kneel, straddling the patient's thighs, with the knees placed at such a distance from the hip bone as will allow the placing of the palms of the hands in the small of the patient's back with the fingers resting on the ribs, the little finger just touching the lowest floating rib, and the thumbs and fingers in a natural position (p. 54).

69. Q. *Describe the compression or expiration stroke in the Schaefer method of artificial respiration.*

A. The compression or expiration stroke in the Schaefer method of artificial respiration is done with the arms held straight. Swing forward slowly so that the weight of the body is gradually brought to bear on the patient, keeping the elbows straight (p. 54).

70. Q. *Describe the position of the operator's arms in relation to the shoulder and heel of the hands at the completion of the compression or expiration stroke in the Schaefer method of artificial respiration.*

A. The shoulder should be directly over the heel of the hand at the end of the forward swing (p. 54).

71. Q. *How long should the compression or expiration stroke in the Schaefer method of artificial respiration take?*

A. The complete compression stroke should take 2 seconds (p. 54).

72. Q. *Describe the decompression or inspiration stroke in the Schaefer method of artificial respiration.*

A. It is made by swinging the body backward so as to remove the pressure completely (p. 54).

73. Q. *How long should the decompression or inspiration stroke take in the Schaefer method of artificial respiration?*
    A. It should consume 2 seconds (p. 54).
74. Q. *How long should the combined expiration and inspiration strokes take, and how many times per minute should the double stroke be given?*
    A. The complete compression-expiration and decompression-inspiration stroke should be completed in 4 seconds, thus permitting 15 double strokes per minute (p. 54).
75. Q. *What care is necessary after the patient has been revived?*
    A. He should be kept lying down, wrapped in a blanket, and given some stimulant, such as aromatic spirits of ammonia (1 teaspoon in one-half glass of water) or hot drinks of coffee or tea (p. 56).
76. Q. *Describe the method of changing operators in the Schaefer method of artificial respiration.*
    A. The relief operator in the Schaefer method of artificial respiration kneels beside the patient and swings forward and backward in unison with the operator giving artificial respiration. At a prearranged backward stroke, the operator swings off the patient on the opposite side from the relief operator and the relief operator swings into position, straddling the patient's legs to make the necessary forward or compression stroke (p. 57). Have class demonstrate the Schaefer method of artificial respiration and change of operators.
77. Q. *Describe the position of the patient in the Sylvester method of artificial respiration.*
    A. Place the patient on his back with the arms at his side (p. 57).

78. Q. *Is a pad used in the Sylvester method of artificial respiration?*
    A. A rolled-up coat or a pad is placed under the patient's shoulders. This helps to straighten the windpipe (p. 59).
79. Q. *What precaution in regard to the tongue is necessary in the Sylvester method of artificial respiration?*
    A. The tongue must be pulled forward and held in that position so that it will not fall back and block the windpipe (p. 59).
80. Q. *Describe the position of the operator in the Sylvester method of artificial respiration.*
    A. The operator kneels just above the patient's head, bending forward and grasping both arms at the wrist (p. 59).
81. Q. *Describe the inspiration stroke in the Sylvester method of artificial respiration.*
    A. Draw the arms from the sides outward and upward gently and steadily and hold them as far as they will go above the head. This movement should be completed in 2 seconds (p. 59).
82. Q. *Describe the compression or expiration stroke in the Sylvester method of artificial respiration.*
    A. Bring the arms down, cross the forearms, and bring them against the chest with moderately increasing pressure. This movement also should be completed in about 2 seconds (p. 59). (Have class demonstrate the Sylvester method of artificial respiration.)
83. Q. *Describe the use of oxygen inhalation in connection with artificial respiration.*
    A. It is advisable that artificial respiration be supplemented by the inhalation of oxygen. Oxygen may be administered by permitting the gas to flow over the patient's face, or may be given by an oxygen inhaler (p. 59).

84. Q. *What are the symptoms of electric shock?*
A. Sudden loss of consciousness, absent or very slight respiration, absent or very weak pulse, and probable burns (p. 60).

85. Q. *When a person who has received an electric shock is still in contact with the electric conductor, what should be done first?*
A. He must be rescued from contact immediately (p. 60).

86. Q. *Name some of the means by which a person may be removed from contact with an electric conductor.*
A. Cutting off the current at a switch; short-circuiting or grounding the current; dragging or prying the person from contact; dragging or prying the conductor from the patient; cutting the conductor (p. 60).

87. Q. *What precautions should be taken by the person removing another from electric contact?*
A. He should always be absolutely sure he is properly insulated from the electric current (p. 60).

88. Q. *Name some of the dangerous gases encountered in mining and metallurgical work and petroleum production and refining.*
A. Methane, carbon dioxide, sulfur dioxide, oxides of nitrogen, ammonia, hydrogen sulfide, carbon monoxide, hydrogen cyanide gas, and cyanogen gas compounds (p. 61).

89. Q. *How may gas poisoning be prevented?*
A. The chief factors in preventing poisoning by gases are good ventilation, avoidance as far as possible of air known to contain poisonous gases, and the use of adequate protective equipment in atmospheres known to contain poisonous gases (p. 66).

90. Q. *Describe the general care of a patient suffering from gas poisoning.*
A. Rescue the patient, and remove him to fresh air as quickly as possible. Procure medical aid; if breathing has stopped or is weak or intermittent, start artificial respiration promptly (p. 66).

768735 O—48——20

91. Q. *How should a drowning person be handled?*
A. He should be removed from the water at once. Water in his air passages and stomach should be removed by raising him several times with the hands locked under his stomach, and artificial respiration should be started (p. 67).
92. Q. *How should a person suffocated or asphyxiated be handled?*
A. He should be removed immediately to fresh air. If some object is blocking his windpipe, it should be removed and artificial respiration started (p. 67).

CIRCULATORY SYSTEM

93. Q. *Of what does the circulatory system consist?*
A. The heart, arteries, veins, and capillaries, by which blood is carried to all parts of the body (p. 68).
94. Q. *Of what does the blood consist?*
A. A fluid called serum or plasma and two types of cells, the red cells and the white cells (p. 68).
95. Q. *What is the function of the blood?*
A. To carry nourishment to all the tissues of the body, to furnish heat and oxygen, and to remove waste matter resulting from tissue activity to the organs of excretion, as the lungs, kidneys, bowels, and skin (p. 68).
96. Q. *What amount of blood does a person weighing 150 pounds have?*
A. About one-twelfth to one-fifteenth of the body weight is blood. A person weighing 150 pounds will have 10 to 12 pints of blood in his body (p. 68).
97. Q. *Describe the heart, its location and action.*
A. The heart is a hollow muscular organ about the size of a fist, in the lower left section of the chest cavity. By its pumplike action, the blood is kept in constant circulation throughout the body (p. 68).

98. Q. *In health, and with a person at rest, how many times does the heart contract per minute?*
A. At the rate of about 72 times per minute (p. 68).
99. Q. *What are the several types of blood vessels?*
A. Arteries, veins, and capillaries (p. 68).
100. Q. *By which type of vessels does the pure blood leave the heart and pass throughout the body?*
A. The arteries (p. 68).
101. Q. *By which type of blood vessels does the impure blood return from all parts of the body to the heart?*
A. The veins (p. 69).

CONTROL OF BLEEDING

102. Q. *What is the second fundamental in first aid?*
A. The second fundamental in first aid is the control of bleeding (p. 70).
103. Q. *What is hemorrhage or bleeding?*
A. A flow of blood from an artery, vein, or capillary (p. 70).
104. Q. *What are the symptoms of bleeding from an artery?*
A. The blood spurts in jerks and is bright red. (p. 70).
105. Q. *What are the symptoms of bleeding from a vein?*
A. Bleeding is a steady flow, and the blood is darker red (p. 70).
106. Q. *What are the symptoms of capillary bleeding?*
A. The blood just oozes from the wound (p. 72).
107. Q. *If blood is spurting from a wound or flowing in a steady stream, what should be done and why?*
A. It should be checked as soon as possible or the patient may lose enough blood to cause shock or endanger life (p. 72).
108. Q. *What amount of blood lost by an adult is liable to prove serious?*
A. The loss of 1 to 2 pints of blood by an adult is usually serious (p. 72).

109. Q. *What amount of blood lost by an adult is liable to prove fatal?*
A. The loss of 2 to 3 pints of blood may prove fatal (p. 72)
110. Q. *What safeguard has nature provided to check bleeding?*
A. The blood flowing from the body is a fluid; but as soon as a blood vessel is cut, nature provides a safeguard in the form of thickening and clotting of the blood at the site of the wound, which tends to stop the flow (p. 72).
111. Q. *Who are "bleeders"?*
A. The blood of some persons will not clot. Such persons are commonly called "bleeders", and they may bleed to death from slight injuries where blood vessels are cut (p. 72).
112. Q. *How may the flow of blood be stopped from a wound with venous bleeding?*
A. Bleeding from a vein usually can be checked by applying a sterile bandage compress directly over the wound. If this fails, a constriction should be applied on the side of the wound away from the heart (p. 72).
113. Q. *How would you stop the flow of blood where capillaries are cut?*
A. By sterile bandage compress applied directly over the wound (p. 74).
114. Q. *Name the methods of controlling bleeding.*
A. Digital pressure, the application of a tourniquet, direct pressure, elevation, and cold applications (p. 75).
115. Q. *What is meant by a pressure point and how many are there on the human body?*
A. A point where an artery comes close enough to the surface of the skin to be reached; it is adjacent to a bony structure to permit pressure on the artery against the bone. There are 22 pressure points on the human body, 11 on each side (p. 75).
116. Q. *Describe digital pressure.*
A. Digital pressure is that exerted by the finger or thumb against an artery at a pressure point (p. 77).

117. Q. *Can tourniquets be applied to all the pressure points?*
A. Tourniquets cannot be applied to all the pressure points on the body. In severe arterial bleeding from a wound where a tourniquet cannot be applied, digital pressure must be maintained until the patient is turned over to a physician and he directs release of pressure (p. 77).
118. Q. *What is a tourniquet?*
A. An appliance used to check severe bleeding from an artery at a pressure point (p. 77).
119. Q. *What types of tourniquets are used in first aid?*
A. The standard type, usually a piece of web belting about 36 inches long with a buckle or snap device to hold it tight when applied, and improvised tourniquets of suitable material to hold a hard object against the pressure point (p. 77).
120. Q. *What precautions should be taken with a hard object used with a tourniquet?*
A. It should be well wrapped or padded with cloth in order not to bruise the skin and the walls of the artery (p. 78).
121. Q. *How long should a tourniquet be permitted to remain tight?*
A. Not longer than 10 minutes (p. 78).
122. Q. *At the expiration of 10 minutes what should be done?*
A. The tourniquet should be loosened for a few seconds or until normal color returns to the part below the tourniquet; if bleeding persists, it should be tightened again for another interval of 10 minutes (p. 78).
123. Q. *What precaution with regard to tourniquets should be exercised in applying other first-aid dressings?*
A. Never cover a tourniquet with a bandage or bind it with a splint so it cannot be seen and loosened or tightened (p. 78).

124. Q. *What is the duty of a first-aid man when he turns a patient with a tourniquet in place over to someone else?*

A. When a patient with a tourniquet or venous-control constriction in place is turned over to someone else, the first-aid man must make known to whoever receives the patient that a tourniquet or constriction has been applied and, if tight, how long it has been tight (p. 79).

125. Q. *What are the symptoms of internal bleeding?*

A. Faintness, cold skin, pale face, dilated pupils, thirst, feeble and irregular breathing, sighing, clouded vision, weak and rapid pulse, dizziness, and later, loss of consciousness (p. 84).

126. Q. *What is the treatment for internal bleeding?*

A. Lay the patient down with head lower than the body, except for fractured skull or apoplexy, when the head is raised. Apply ice or cold cloths to the body at the point at which you suspect the bleeding is present. Do not give stimulants unless absolutely necessary. *Procure medical aid immediately* (p. 84).

Have class apply digital pressure on the pressure points for controlling arterial bleeding for—

Wound and bleeding of scalp.
Wound and bleeding of face.
Wound and bleeding of neck.
Wound and bleeding of armpit or arm torn from body.
Wound and bleeding of arm.
Wound and bleeding of forearm.
Wound and bleeding of hand.
Wound and bleeding of groin.
Wound and bleeding of thigh.
Wound and bleeding of leg.
Wound and bleeding of foot.

NERVOUS SYSTEM

127. Q. *What is the function of the nervous system?*
A. The various parts of the body and organs controlling the body functions are kept in touch with each other and their activities regulated by the nervous system (p. 84).

128. Q. *What is the sympathetic nervous system?*
A. A series of nerve centers called ganglions in the chest and abdominal cavities along the spinal column. Each of these ganglions or nerve centers is interconnected with the cerebrospinal system (p. 85).

129. Q. *What does the sympathetic nervous system control?*
A. It presides over and controls vital organs and vital functions. It is not under the control of the will, but through it vital functions, such as heart action, breathing, and blood pressure, are maintained involuntarily, whether we are awake or asleep, independent of any effort on our part (p. 85).

PHYSICAL SHOCK

130. Q. *What is the third fundamental in first aid?*
A. The treatment for physical shock (p. 86).

131. Q. *What is physical shock?*
A. A state of collapse or prostration in which the normal action of the heart, the respiration, and the circulation are interfered with (p. 86).

132. Q. *What part does the sympathetic nervous system play in physical shock?*
A. Due to disarrangement or lack of proper balance within the sympathetic system there is partial loss of control over the vital functions of respiration, circulation, and blood pressure (p. 86).

133. Q. *What are the causes of physical shock?*
A. Severe or extensive injuries, severe pain, loss of blood, surgical operations, severe burns, accidents due to electricity or gas, certain illnesses, poisons taken internally, exposure to extremes of heat or cold, seeing own injuries or injuries of others, fright, anger, and joy (p. 86).

134. Q. *Does physical shock always occur immediately after an injury?*
A. Physical shock may develop rapidly or may be delayed and manifest itself hours later (p. 86).

135. Q. *Does physical shock occur after every injury?*
A. Physical shock occurs to some degree after every injury. It may be so slight as not to be noticed. (p. 86).

136. Q. *May physical shock prove dangerous to life?*
A. In many injuries physical shock is an extremely serious condition, and patients may die from its effects where the injuries received ordinarily would not prove fatal (p. 86).

137. Q. *How soon after the symptoms of physical shock are noticed should it be treated?*
A. Physical shock should be treated immediately after the first evidence of its presence (p. 86).

138. Q. *What are the symptoms of physical shock?*
A. Face is pale with an anxious or dull expression. The eyelids, if open, droop; the pupils are large, and the eyes are dull. The patient may be partly or totally unconscious. The skin is cold and covered with a clammy sweat. The patient feels cold and may have a chill. The pulse is weak and rapid if it can be felt. The breathing is shallow and may be irregular. The patient is stupid and takes little interest in things about him. He may answer questions slowly or apparently fail to understand. Nausea and vomiting may be present (p. 86).

139. Q. *What is the treatment for physical shock?*

A. Place patient in a comforable position lying down, with his head on a level with his body; if there is a moderate slope to the ground where the patient is lying, place the head toward the down grade. If the patient is on a stretcher or body splint, elevate the feet end of the stretcher or body splint at least 6 inches. Remove all foreign bodies from the mouth, and cleanse the mouth of mucus or phlegm. See that the tongue is forward and not back over the windpipe. Loosen tight clothing from waist and neck. If nausea and vomiting are present, turn patient's head to one side so that the vomited matter will flow from the mouth. Permit patient to have plenty of fresh air. Wrap the patient in blankets or other suitable covering. Care should be taken that the material placed around patient does not contaminate open wounds. Maintain heat under the covering by applying heated objects. Give stimulants, by inhalation if unconscious or by mouth if conscious. Rub uninjured extremities toward the heart. Oxygen should be administered if available (p. 88).

140. Q. *How should stimulants be given to an unconscious person in physical shock?*

A. Give nothing by mouth, as patient may not swallow it, and the substance may pass into his windpipe and choke him. Aromatic spirits of ammonia should be given by pouring some on a piece of gauze or cloth and holding under the nose for 30 to 40 seconds. The aromatic spirits should be tested before the patient is allowed to inhale it (p. 89).

141. Q. *Under what conditions where physical shock is present should the head be raised?*

A. Fracture of the skull, unchecked severe bleeding from the head, sunstroke, and apoplexy (pp. 95, 96, 172).

142. Q. *Under what condition where physical shock is present should the patient not be wrapped in blankets or heated objects be applied?*
A. In sunstroke (p. 96).
143. Q. *Under what conditions where physical shock in present should no stimulant be given?*
A. Where arterial bleeding has not been controlled, in fracture of the skull, internal bleeding, apoplexy, or sunstroke (p. 89).
144. Q. *What is fainting?*
A. Temporary loss of consciousness due to an insufficient supply of blood to the brain; it is a mild form of physical shock (p. 92).
145. Q. *What are the symptoms of fainting?*
A. Patient feels weak and dizzy, black spots appear before his eyes, his face becomes pale and lips blue, the forehead is covered with perspiration, and he sinks back in his seat or falls to the ground unconscious. The pulse is rapid and weak and breathing shallow (p. 92).
146. Q. *What is the treatment for fainting?*
A. Place patient lying down with head low. Cleanse mouth. Loosen tight clothing at neck and waist. Allow patient to have plenty of fresh air. Give aromatic spirits of ammonia by inhalation (p. 93).
147. Q. *What is heat exhaustion?*
A. Collapse from the effects of heat, either that from the sun or from any other source (p. 93).
148. Q. *What are the symptoms of heat exhaustion?*
A. Patient is seldom unconscious but complains of feeling very weak. The face is pale, anxious looking, and covered with cold perspiration. The patient may complain of feeling chilly. The pulse is rapid and weak. The breathing is shallow, with little chest expansion. (p. 94).

149. Q. *What is the treatment for heat exhaustion?*
A. The same as that for physical shock (p. 94).
150. Q. *What are heat cramps?*
A. Painful spasms of muscles, especially those of the abdomen and limbs, occurring after exposure to high temperatures while engaged in strenuous labor. (p. 94).
151. Q. *How may heat cramps be prevented?*
A. Men at hard work in high temperatures should drink adequate amounts of cool water—10 to 15 glasses per day, adding to each glass of water a good-size pinch of salt or a salt tablet, such as is supplied by dispensing cabinets usually placed near drinking fountains. Clothing while at work should be light and porous to promote evaporation. Constipation should be avoided (p. 95).
152. Q. *What is sunstroke?*
A. A sudden attack of illness from prolonged exposure to the direct rays of the sun or to other high temperatures, particularly when a person is engaged in hard labor (p. 95).
153. Q. *What are the symptoms of sunstroke?*
A. The attack is sudden, and the patient becomes unconscious rapidly. Unconsciousness may be preceded by intense headache and dizziness. The face is red and flushed. The skin is hot and dry, with no perspiration. The pulse is slow and full and even may be bounding in character. Breathing is labored and of a snoring type. The pupils of the eyes are enlarged but of equal size (p. 95).
154. Q. *What is the treatment for sunstroke?*
A. Owing to excessive body temperature, treatment centers around reducing the high temperature as soon as possible. Remove patient to a cool place and lay him down with head raised. Remove as much clothing as

necessary, and apply cold applications to body and head. Rub patient's limbs toward the heart to promote circulation temporarily. Give no stimulants. Sunstroke is a very dangerous condition, so procure medical aid at once (p. 96).

155. Q. *What is apoplexy (cerebral hemorrhage)?*
A. Spontaneous rupture of a blood vessel in the skull, causing hemorrhage into the brain tissues. It usually occurs in elderly persons (p. 96).

156. Q. *What are the symptoms of apoplexy?*
A. Patient may complain of severe headache before becoming unconscious. His face is flushed and warm. The pulse at first is slow and strong but later becomes rapid and weak. Respiration is slow, and snoring may be present, lips and cheeks puffing out at each expiration. The pupils of the eyes are unequal in size. Frequently the mouth is drawn to one side, and if patient tries to talk, he mumbles out of one side of his mouth. There is usually paralysis on one side of the body (p. 97).

157. Q. *What is the treatment for apoplexy?*
A. Keep patient lying down with head raised. Allow him to have plenty of fresh air but keep him warm. Apply cold applications or ice bag to head. Give no stimulant. Keep patient absolutely quiet, and do not move him unless necessary. Obtain medical care at once (p. 97).

158. Q. *What role does the skin play in preventing infections?*
A. The skin covering the outside of the body, when unbroken, affords protection from most agencies causing infection. Usually germs enter the body and increase in large enough numbers to cause what is commonly known in first aid as infection only where the skin has been broken. Therefore, the skin affords our first line of defense against infections (p. 97).

159. Q. *What is infection?*
A. Present everywhere in nature, except in sterilized articles, are numerous small vegetable organisms known as bacteria (germs). These minute organisms are far too small to be seen by the eye alone and can be viewed only with a high-powered microscope. When many types of these germs gain entrance into the body they increase in number owing to conditions suitable to growth beneath the skin. Through multiplication and the formation of poisonous products, they cause harmful body conditions known as infection (p. 98).

WOUNDS AND BURNS

160. Q. *What is the fourth fundamental in first aid?*
A. The care of open wounds and burns (pp. 99, 134).
161. Q. *What is an open wound?*
A. Any break in the skin. It may range from a pin puncture or scratch to an extensive cut, tear, or mash (p. 99).
162. Q. *How are open wounds classified in first aid?*
A. As abrasions, incised wounds, lacerated wounds, and punctured wounds (pp. 99, 100).
163. Q. *What is an abrasion?*
A. A wound caused by rubbing or scraping. It usually is not deep, but a portion of the skin has been removed, leaving a raw bleeding surface. Bleeding in most abrasions is capillary only. Owing to the amount of underskin exposed, abrasions are easily infected (p. 99).
164. Q. *What is an incised wound?*
A. A wound caused by a sharp cutting edge such as a knife, piece of glass, or piece of metal. The edges of the wound are divided smoothly without bruising or

tearing. Incised wounds bleed freely and are not so liable to infection as the other types of wounds (p. 99).

165. Q. *What is a lacerated wound?*
A. A wound presenting ragged edges that have been torn or mashed by a blunt instrument, machinery, or rough surfaces. As the blood vessels are torn or mashed, lacerated wounds do not bleed as freely as incised wounds. The lacerated and torn tissues, together with the fact that foreign matter is often forced or ground into the wound, make the danger of infection greater than in incised wounds (p. 100).

166. Q. *What are punctured wounds?*
A. Wounds produced by pointed instruments, such as needles, splinters, nails, or pieces of wire. Such wounds are small, but often very deep. Most articles causing punctured wounds are soiled, and matter capable of causing infection often is introduced deep in the tissues. The small opening in punctured wounds and the few blood vessels cut prevent free bleeding. The danger of infection in punctured wounds is far greater than in other types (p. 100).

167. Q. *Describe the general care of open wounds.*
A. Check hemorrhage, and prevent any germs from entering wound by covering immediately with a sterile dressing (p. 100).

168. Q. *Tell how the clothing should be removed to expose wounds.*
A. Rip or cut the clothing so that the injury may be seen (p. 100).

169. Q. *What should be done where loose, foreign particles are in or around an open wound?*
A. Loose, foreign particles in and around a wound may be wiped away with sterile gauze. Always wipe away from the wound and not toward it (p. 100).

170. Q. *What should be done where foreign objects are embedded in an open wound?*

A. Do not attempt to remove a foreign object embedded in a wound. Leave that to the doctor, as it may aid him in determining the extent of injury and involvement of deeper parts (p. 100).

171. Q. *What only may touch an open wound?*

A. A sterile bandage compress or sterile gauze placed over the wound and tied in place. Do not touch an open wound with your hand, clothing, or anything that is not sterile (p. 101).

172. Q. *How large should sterile dressings be for an open wound?*

A. Care should be taken to make all sterile dressings wide enough to cover the wound completely, as well as an area beyond each side of the wound (p. 101).

173. Q. *Where is the knot usually tied in dressing an open wound?*

A. Unless otherwise specified, the knots of sterile bandage compresses and cover bandages should be tied over the wound on top of the pad of the compress to assist in checking bleeding (p. 101).

174. Q. *How should bandages be applied in dressings for open wounds?*

A. The bandage should be applied firmly but never too tightly. In bandaging the arms and legs, leave the tips of the fingers and toes uncovered wherever possible so that they may be seen, to permit easy examination and determine whether or not dressings are too tight (p. 102).

Have class demonstrate dressings for the following open wounds:

Extensive wounds and bleeding of scalp.

Wound and bleeding of scalp, temple, ear, or face.

Wound and bleeding of forehead or back of head.

Injuries of eye.
Wound and bleeding of nose.
Wound and bleeding of chin.
Wound and bleeding of neck or throat.
Wound and bleeding of shoulder.
Wound and bleeding of armpit.
Wound and bleeding of arm.
Wound and bleeding of elbow.
Wound and bleeding of forearm.
Wound and bleeding of wrists.
Wound and bleeding of palm of hand.
Wound and bleeding of back of hand.
Extensive wounds and bleeding of hand.
Wound and bleeding of back between shoulders.
Wound and bleeding of chest between shoulders.
Wound and bleeding of back, chest, abdomen, or side.
Wound and bleeding of lower part of abdomen, lower part of back, or buttocks.
Wound and bleeding of groin.
Wound and bleeding of crotch.
Wound and bleeding of hip.
Wound and bleeding of thigh.
Wound and bleeding of knee.
Wound and bleeding of leg.
Wound and bleeding of ankle or foot.
Extensive wounds and bleeding of foot.

BURNS AND SCALDS

175. Q. *Name some of the causes of burns and scalds.*
A. Dry heat, fire, heated objects, electricity, friction, hot solutions, steam, vapors, and chemicals, such as strong acids or strong alkalies (p. 134).

176. Q. *How are burns classified according to their seriousness?*

A. By degrees. A first-degree burn is one in which the surface of the skin is only scorched, causing reddening and slight swelling; a second- degree burn is more severe, the under layer of skin being involved, causing in addition to redness and swelling the formation of blisters; a third-degree burn is one where the outer skin has been destroyed and the tissues beneath the skin are damaged (p. 134).

177. Q. *Does shock usually accompany burns and scalds?*
A. Shock is usually present in all burns and scalds (p. 135).

178. Q. *Describe general treatment for burns and scalds.*
A. Expose the burned surface, and apply a dressing to exclude the air, relieve pain, and prevent infection (p. 135).

179. Q. *How should all clothing be removed from a burned area?*
A. By cutting or ripping; any cloth that adheres to the skin should be cut around and left in place (p. 135).

180. Q. *Name three principal products used in first aid to dress burns and scalds.*
A. Picric-acid gauze, tannic acid, and water-soluble burn ointments (p. 135).

181. Q. *Should products containing grease or oil be used in dressing burns and scalds? Give reason.*
A. Modern treatment for burns and scalds employs water-soluble drugs, and the use of grease or oils in first-aid care makes necessary the cleaning of burned or scalded surfaces with a solvent before medical treatment can be started. This delays the medical treatment and is very painful to the patient. Therefore, first-aid dressings for burns and scalds should be free from grease or oil (p. 135).

182. Q. *Are burns and scalds subject to infection?*
A. Yes, just as are open wounds (p. 136).

768735 O—48——21

183. Q. *Should blisters be opened?*
A. Blisters should not be intentionally opened or broken (p. 136).

184. Q. *Describe use of picric-acid gauze.*
A. Picric-acid gauze comes folded, usually in sealed packets. It should be unfolded carefully so that the part to be applied to the burn comes in contact with nothing else. After being placed over the burned surface, the gauze should be well-moistened with clean water; a loosely applied cover bandage should be tied on the outside. To keep the picric-acid gauze moist, the outside cover bandage may also be wet (p. 135).

185. Q. *How may tannic acid be applied?*
A. A 5- to 10-percent solution of tannic acid may be sprayed over the burned surface and covered with sterile gauze; or sterile gauze may be soaked in the solution and applied to the burn or scald. Like picric-acid gauze, it must be covered with a loosely applied cover bandage (p. 136).

186. Q. *What precautions are necessary in dressing a burn or scald where burned or scalded surfaces may come in contact with each other?*
A. Adjacent burned surfaces should never be permitted to come in contact with each other. A burn dressing should be placed between such surfaces (p. 136).

187. Q. *How should bandages be applied in dressing burns or scalds?*
A. They should always be applied loosely, but snugly enough to hold in place (p. 137).

188. Q. *Describe treatment for chemical burns.*
A. Chemical burns should be washed thoroughly with clean water to dilute the chemical before a burn dressing is applied. This washing is done by flowing clean

water over the entire burned area for a period ranging from 5 to 10 minutes, depending on the seriousness of the burn (p. 137).

189. Q. *Describe treatment for chemical burns of the eye.*
A. Chemical burns of the eye should be washed freely with cold water. To do this, it is best to have the patient lying down and the eyelids held open by the fingers and the water flowed into the inner corner of the eye from a pitcher or other container. Use plenty of water, and wash the eye thoroughly, being sure the water actually flows across the eye (p. 137).

Have class demonstrate dressings for—

Burns of face, head, and neck.
Burns of shoulder.
Burns of arm.
Burns of forearm.
Burns of hand.
Burns of back.
Burns of chest.
Burns of lower part of abdomen, lower part of back, or buttocks.
Burns of hip.
Burns of thigh.
Burns of leg.
Burns of foot.

CLOSED WOUNDS

190. Q. *What is a bruise? Give symptoms.*
A. An injury caused by some blunt instrument or object striking the body or by the body coming in contact with a hard object. Usually the skin is not broken, but the soft tissues beneath the skin are injured. Small blood vessels are ruptured, causing blood to seep into the surrounding tissues, which produces

swelling, at first red but later turning darker to a blue or purple discoloration. The symptoms of a bruise are immediate pain, swelling, and discoloration (p. 146).

191. Q. *What is the treatment for a bruise?*
A. The treatment should be to limit swelling and decrease pain by application of cold, elevation of the part, and placing it at complete rest (p. 148).

192. Q. *What is a strain? Give symptoms.*
A. Overstretching of a muscle or tendon of a muscle. Symptoms are a sharp pain or cramp immediately; any attempt to use the muscle is difficult and painful. Moderate swelling may be present (p. 148).

193. Q. *What is the treatment for a strain?*
A. Place patient in a comfortable position, and apply hot applications. In most strains dry heat is more effective than moist heat. Follow by rubbing the part with warm alcohol or witch hazel, massage to stimulate circulation, and keep the part at rest to prevent further congestion (p. 148).

194. Q. *What is a sprain? Give symptoms.*
A. An injury due to stretching or tearing of the ligaments or other tissues around a joint. The symptoms are pain around the joint, inability to use the joint, and swelling, which is rapid and marked, followed by discoloration (p. 149).

195. Q. *What is the treatment for a sprain?*
A. Place the injured joint at rest and in an elevated posiposition. Cold applications can be used to limit the swelling if cared for early, followed by hot applications to relieve pain. The joint may be bound firmly by cravat bandage. Never attempt to strap a sprained joint with adhesive tape (p. 149).

196. Q. *What should be done where doubt exists whether a sprain, dislocation, or fracture is present?*

A. Owing to the great amount of swelling in some sprains, it is often difficult to determine whether a joint has been sprained or dislocated or whether a fracture has occurred in or near the joint. Such cases should receive medical attention promptly and meanwhile it is best to treat it as a fracture (p. 149).

Have class demonstrate the dressing for a sprained ankle.

197. Q. *What is a rupture or hernia?*

A. The protrusion of a portion of an internal organ, usually the bowel, through the muscular wall of the abdomen (p. 150).

198. Q. *What are the symptoms of a rupture?*

A. A sharp, stinging pain and a feeling of something giving way at the location of the rupture. Upon examination, a swelling is found, ranging in size from that of a marble to that of the doubled-up fist or even larger. The swelling usually is tender. Nausea and vomiting may occur (p. 150)

199. Q. *What is the treatment for rupture?*

A. Lay the patient on his back, his knees well drawn up and supported by a large pad. Apply ice or cold applications to the swelling, and obtain medical assistance. Never attempt to reduce the swelling, as serious damage may be caused to the bowel or its covering. If the patient has to be transported, transport him in a lying position with his knees tied up against the pad (p. 151).

200. Q. *How may strains of the back and ruptures be avoided in lifting heavy weights?*

A. Use the strong muscles of the legs and arms instead of the muscles of the back and abdomen. When lifting an object from the ground, instead of stooping over by bending the back at the waist, bend the knees but keep the feet as close together as possible.

See that the body weight is distributed evenly on each foot, and keep the back straight. Raise the object by straightening the legs, making the fullest use of the leg and arm muscles, taking most of the strain from the back and abdominal muscles. Do not attempt to move or raise weights that are too heavy; get assistance (p. 149).

201. Q. *Describe treatment for foreign bodies in the eye.*

A. Instruct the patient not to rub the eyes, because rubbing may cause scratches of the delicate eye tissues or force a foreign particle with sharp edges into the eyeball, making its removal difficult. When a foreign body lodges under the upper lid, it sometimes may be removed by drawing the upper lid down over the lower lid and as the upper lid returns to its position it passes over the outside of the lower lid and the foreign body is removed by the wiping action. A foreign body lodged under the lower lid may be removed in the same manner by pulling up the lower lid over the upper one. If the foreign object can be seen, it may be wiped carefully from the eye by a corner of a piece of sterile gauze. Particles that appear to be embedded in the eyeball should not be disturbed; the patient should be sent at once to a physician for removal of the object, as it requires skill and desensitizing of the eye. Never use the point of a knife blade, toothpick, or matchstick to dislodge a foreign body from the eye. In all cases where the eye becomes inflamed from a foreign object, the patient should have medical attention (p. 153).

202. Q. *What is the treatment for foreign bodies in the ear?*

A. They may be floated out by use of warm oil, such as sweet oil, olive oil, or mineral oil, which should be heated to body temperature before being placed in the ear. After the oil has been in the ear several min-

utes, turn the head so that the ear is down, and the foreign body may float out. Never use pins, hairpins, or pieces of wire in an attempt to dislodge foreign bodies from the ear, as such objects may damage the tissue of the ear or puncture the ear drum. Foreign bodies that cannot be removed readily from the ear should receive medical attention (p. 154).

203. Q. *What is the treatment for removing foreign bodies from the nose?*

A. Sneezing, induced by the use of snuff or pepper or by tickling the nose with a feather or similar object, may remove the foreign body from the nose. Hard blowing of the nose with the unobstructed nostril held closed also may be used in attempting to dislodge foreign bodies from the nose. Should the above methods fail, medical attention should be obtained (p. 155).

204. Q. *Describe treatment of foreign bodies in the throat or windpipe.*

A. By holding the tongue down, examine the throat. Sometimes the foreign object may be seen. If so, pass the finger into the throat alongside the tongue, and try to withdraw the object. Use care that the object is not pushed farther into the throat or windpipe. Foreign bodies that cannot be seen or felt with the finger may be dislodged by coughing or slapping the person on the back between the shoulder blades. This is materially aided if the patient is in a lying position with the head much lower than the body. Young children may be held by the legs with the head down and slapped between the shoulders to dislodge foreign bodies from the throat and windpipe. If foreign bodies cannot be removed by the above methods, send immediately for a physician; meanwhile if there is serious hindrance to breathing, perform artificial respiration (p. 155).

205. Q. *What is the treatment for foreign bodies in the stomach?*
A. In first aid, no attempt should be made to dislodge foreign bodies from the stomach. Give the patient nothing to cause vomiting or to move the bowels, but get medical aid and leave the treatment to the physician (p. 156).

DISLOCATIONS AND FRACTURES

206. Q. *What is the fifth fundamental in first aid?*
A. The care of dislocations and fractures (pp. 156, 169).
207. Q. *What is a dislocation?*
A. A dislocation is a slipping out of normal position of one or more bones forming a joint (p. 156).
208. Q. *What other injuries usually accompany a dislocation?*
A. The ligaments holding the bones in proper position are stretched and sometimes torn (p. 156).
290. Q. *What are the general symptoms of dislocations?*
A. Rigidity and loss of function. The parts forming the joint are held stiff and cannot be moved. There is deformity; that is, the parts assume an unnatural shape compared with the normal joint on the opposite side of the body. In dislocations of the extremities, they may be either shorter or longer than normal. Pain usually is severe in the region of the joint. Swelling is present about the joint (p. 157).
210. Q. *What is the general treatment for dislocations?*
A. Applying dressings, and in some instances splints, so that the parts are immobilized in the line of deformity in which they are found (p. 157).
211. Q. *What dislocations may a first-aid man attempt to reduce?*
A. In first aid, dislocations of the lower jaw, fingers, and toes may be reduced (p. 157).

212. Q. *Why should not all dislocations be reduced in first aid?*

A. The reduction of the major dislocations requires skill in the manipulation of the parts so as not to damage further the joints, ligaments, and numerous blood vessels and nerves found close to the joints. Only a physician is trained to reduce major dislocations properly (p. 157).

Have class demonstrate dressings for the following dislocations:

Dislocation of lower jaw.
Dislocation of shoulder.
Dislocation of elbow, arm straight.
Dislocation of elbow, arm bent.
Dislocation of wrist.
Dislocation of hip.
Dislocation of knee or kneecap.
Dislocation of ankle.

213. Q. *What is a fracture?*

A. A break in a bone (p. 169).

214. Q. *Name the kinds of fractures cared for in first aid.*

A. Simple fractures and compound fractures (p. 169).

215. Q. *What is a simple fracture?*

A. One in which the bone is broken but there is no wound extending from the ends of the bone out through the skin (p. 169).

216. Q. *What is a compound fracture?*

A. One in which the bone is broken and a wound extends from the bone through the skin. The wound in a compound fracture may be caused by one or both ends of the broken bone being forced out through the tissues and skin or by some object piercing the skin and tissues to the bone and breaking it (p. 169).

217. Q. *How may a simple fracture be converted into a compound fracture?*

A. Broken bones, especially the long bones of the extremities, often have sharp, saw-toothed edges, and even slight movement may cause these sharp edges to cut into tissues, blood vessels, and even through the skin. A simple fracture, therefore, can be converted by careless and improper handling into a compound fracture (p. 169).

218. Q. *What are the general symptoms of fractures?*

A. Pain in the region of the fracture, loss of function (if the long bones are involved), deformity or irregularity of the part, and swelling, moderate or severe; in fractures of the extremities, the limbs usually are shortened (p. 170).

219. Q. *What precautions should be exercised in examining an injured person?*

A. Examine all injured persons carefully, particularly those suffering from apparent fractures. Do not attempt to change the position of the injured person until you have made a careful examination. Do not permit a person to sit up until after you have examined him and are certain that the changed position will not complicate his injuries (p. 170).

220. Q. *What is the general treatment of fractures?*

A. Place the part in a position as nearly normal as possible; and, while support is maintained, prepare and apply a splint to immobilize the part so that movement is impossible (p. 170).

221. Q. *How does the treatment of a simple fracture differ from that of a compound fracture?*

A. A simple fracture requires only immobilization by proper dressings, whereas a compound fracture requires that a tourniquet be applied, tightly if there is evidence of arterial bleeding, otherwise loosely. The wound must be dressed appropriately. When the splints are applied in a compound fracture, the

padding must be so arranged that the tourniquet can be tightened or loosened and that no pressure is made over the wound or on protruding ends of bones. Shock may be present in either simple or compound fractures (p. 170).

222. Q. *State how bandages should be placed for applying splints.*

A. Bandages should be placed under splints and parts of body to be splinted by means of a thin stick, taking advantage of the natural arches of the part. After the bandages have been passed under the part, they should be gently moved up or down to the position in which they are to be tied (p. 171).

223. Q. *What are the symptoms of a fractured skull?*

A. The patient may be conscious or unconscious. If the fracture is at or near the base of the skull, a mixture of blood and serum may flow from one or both ears. Bleeding from the nose and mouth and into the eyes may be present. The pupils of the eyes are of unequal size. There may be a surface wound on the head, although the skull may be fractured and no open wound be present (p. 172).

224. Q. *What is the treatment for a fracture of the skull?*

A. In all fractures or suspected fractures of the skull, keep the patient lying down with the head raised by a pad. The head should be turned to a position away from the location of the suspected fracture. If there is a wound, control bleeding and dress the wound. The knots of the bandage compress and cover bandage always are tied away from the wound to prevent depressing fragments of bone into the brain. Cold applications may be applied to the head in the region of the fracture. Keep the patient warm, and treat for shock, which is usually severe. Never give a stimulant. Obtain medical care promptly (p. 172).

225. Q. *What are the symptoms of a fracture of the lower jaw?*
A. The mouth usually is open, and saliva mixed with blood flows from one or both corners of the mouth. Talking is painful and difficult. The teeth of the lower jaw are uneven at the break, usually with some teeth either loosened or knocked out (p. 173).

226. Q. *What are the symptoms of a fracture of the collarbone?*
A. The arm of the injured side is partly helpless. The shoulder on the side of the injured part is lower and tends to droop forward. The patient frequently holds the forearm bent across his chest and supports the injured arm at the elbow with his other hand. An irregularity can be seen and felt along the fractured collarbone (p. 173).

227. Q. *What are the symptoms of fracture of the rib?*
A. Severe pain on breathing, tenderness over the fracture, and inability to take a deep breath on account of pain. In a thin person, the fracture may be seen under the skin (p. 181).

228. Q. *What is a fracture of the spine?*
A. A break at any point in the spinal column between the head and the pelvis (p. 183).

229. Q. *What is the danger in a fracture of the spine?*
A. The spinal cord may be cut or so severely pinched by displacement as to cause paralysis (p. 183).

230. Q. *How would you determine whether a patient has a fracture of the spine in the neck region or below the neck region?*
A. If he is conscious ask him to move his legs and arms. If the legs cannot be moved and there is no fracture or dislocation of the legs, his back probably is broken and the spinal cord cut, or pressure is being made on it. If his arms as well as his legs cannot be moved and there is no fracture or dislocation of

the arms, his spinal column is fractured high up, probably in the neck region. Where a patient is unconscious, paralysis may be determined by pinching or by sticking a pin or the point of a knife blade into his feet or hands. When an unconscious person is pinched severely or the point of a pin or knife is stuck into his hand or foot and paralysis is not present, there is a reflex muscular action of drawing the hand or foot away from the pinched area or from the pointed object. If there is no reflex muscular action in the feet, the back is broken, and if there is no reflex muscular action in the hands, the neck is broken (p. 185).

231. Q. *Describe briefly the position of the patient on the splint in the dressing for a broken neck.*

A. Place the patient on the splint on his back, with proper padding around his head and neck to prevent any movement of the head, neck, or shoulders. The head is never raised but kept at all times on a level with the body (p. 185).

232. Q. *Describe briefly the position of the patient on the splint for dressing for broken back.*

A. Place the patient face down, with additional padding under the upper portion of the chest and additional padding extending from the crotch down to the ankles (p. 188).

233. Q. *What are the symptoms of fracture of the pelvis?*

A. Great pain through the pelvis and inability to move either or both thighs (p. 190).

234. Q. *What special danger attends fracture of the pelvis?*

A. Displacement of bones often causes injury to the abdominal organs, particularly rupture of the bladder (p. 190).

Have class demonstrate dressings for the following fractures, including support of fractures, proper lifting and placing of the patient on splints, application of tourniquets and dressing of wounds in compound fractures, and proper padding of splints:

Dressing for fracture of nose.
Dressing for fracture of lower jaw.
Dressing for fracture of collarbone.
Dressing for fracture of shoulderblade.
Dressing for fracture of upper third of arm.
Dressing for fracture of lower two-thirds of arm, elbow, forearm, and wrist.
Dressing for fracture or crushing of bones of hand or fingers.
Dressing for fracture of ribs.
Dressing for fracture of spine in neck region.
Dressing for fracture of spine below neck region.
Dressing for fracture of pelvis.
Dressing for fracture of thigh, knee, and ankle.
Dressing for fracture of kneecap.
Dressing for fracture of leg.
Dressing for fracture or crushing of bones on foot or toes.

The following questions under fractures apply only to classes that have received instruction on fixed traction in applying splints for fractures of the extremities:

235. Q. *What is meant by fixed traction in applying splints for fractures of the long bones of the extremities?*

A. Fixed traction in applying splints for fractures of the long bones of the extremities requires that the fractured extremity be brought to normal position and length immediately by extension and that fixed traction be maintained continuously during the application of the splint and after it has been applied (p. 196).

236. Q. *Describe the method of applying fixed traction to the long bones of the extremities.*

A. In treatment of a fracture of the extremity where fixed traction is to be used, place the limb carefully in as nearly natural position as possible by taking hold of the lower part well below the fracture and pulling gently but steadily until the limb is approximately normal in length. While this fixed traction is being maintained, appropriate splints are applied with the limb maintained under fixed traction (p. 197).

237. Q. *What are some of the advantages of fixed traction?*

A. There is marked decrease in the severity of shock, lessened pain, less damage to surrounding tissues, blood vessels, and nerves; in most cases, there is a reduction in the length of disability (p. 197).

238. Q. *What two types of splints are used in first aid in dressing fractures by fixed traction?*

A. Thomas-type prepared wire splints and wood splints (p. 197). Have class demonstrate dressings for the following fractures where fixed traction is used in applying splints:

Fracture of upper extremity, using Murray-Jones full-ring prepared wire splint. Fracture of the upper extremity, using wood splint.

Fracture of lower extremity, using Keller-Blake half-ring prepared wire splint. Fracture of lower extremity, using wood splint.

POISONS

239. Q. *What four ways may poisons gain access to the body?*

A. Poisons may gain entrance to the body through several channels:

1. Taken by mouth and swallowed, intentionally or by mistake.

2. Breathed in with inhaled air, as certain noxious dusts, gases, fumes, and mists.
3. Injected within the skin, as in bites of rabid animals, poisonous snakes, and bites and stings of insects.
4. Through contact with the skin, as organic or inorganic cutaneous irritants, poisonous plants, and certain fungi (p. 208).

240. Q. *What are corrosive poisons?*
A. Corrosive poisons are substances that corrode, burn, or eat into the tissues when they come in contact with the mucous membrane of the lips, mouth, throat, gullet, and stomach (p. 209).

241. Q. *Name some corrosive poisons.*
A. The common corrosive acids are hydrochloric, sulfuric, nitric, oxalic, and carbolic acid, and lysol. The common corrosive alkalies are potash or caustic potash, soda or caustic soda, lye, unslaked lime, and strong ammonia water (p. 209).

242. Q. *What is the treatment for the corrosive poisons?*
A. Determine, if possible, whether an acid or an alkali has been taken. Never give an emetic. For acids, except carbolic acid and lysol, give limewater, chalk and water, milk of magnesia, or 1 teaspoon of baking soda in a cup of lukewarm water. For the alkalies, give a weak acid solution, such as equal parts of vinegar and water, or lemon or orange juice. In treatment for poisoning by acids and alkalies, dilute the poison and soothe corroded tissues by repeated drinks of milk, raw eggs beaten in milk or water, olive oil, salad oil, barley water, or a thin gruel made from the soft cereals. Watch for physical shock, and treat it if present (p. 210).

243. Q. *What are the symptoms and treatment for carbolic acid or lysol poisoning?*

A. The odor of carbolic acid or lysol will be noticed on patient's breath. Moreover, he will probably vomit, and the vomited matter will have the characteristic odor of carbolic acid or lysol. The general symptoms are those of corrosive poisons. The treatment for carbolic acid or lysol poisoning is to wash the mouth with equal parts of grain alcohol and water. Permit patient to have repeated small drinks of whisky or brandy in equal parts with water, or wine undiluted. In the absence of alcoholic liquors, give the whites of raw eggs beaten in water, soapsuds, or diluted vinegar. Do not give milk or oil until the stomach has been completely emptied. Later, give the patient large quantities of salt water, mustard water, or alum water, one tablespoon in a glass of lukewarm water. When stomach has been emptied, gruel or flaxseed tea may be given to soothe the corroded tissues. Watch for physical shock, and treat it promptly (p. 210).

244. Q. *What are the irritant poisons?*

A. Substances that when swallowed irritate the stomach, causing nausea, distress, vomiting, and severe pain (p. 211).

245. Q. *What are the common irritant poisons?*

A. Metals or salts of metals, antimony and many of its combinations, arsenic and many of its combinations, all of the combinations of copper, iodine and many of its combinations, all the combinations of lead, all the combinations of mercury, phosphorus and many of its combinations, silver nitrate, and all the combinations of zinc (p. 211).

246. Q. *What is the general treatment for the irritant poisons?*

A. Determine, if possible, the kind of poison taken, promote vomiting, and empty the stomach as soon as possible. Give salt water, mustard water, or alum water, 1 tablespoon to a glass of lukewarm water.

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Repeat the above until the patient has vomited several times. After the stomach has been emptied, give the whites of eggs or milk, except in phosphorus poisoning, barley water, or thin gruel made from the soft cereals. Watch for physical shock and treat it if necessary (p. 212).

247. Q. *What is the special treatment for iodine poisoning?*
A. Give at once large quantities of starch mixed with water or a thin paste of flour mixed with water before attempting to promote vomiting, or even if vomiting has occurred. Follow with the general irritant-poisoning treatment (p. 212).

248. Q. *What is the special treatment for copper or mercury poisoning?*
A. Give whites of eggs beaten up with water or milk before attempting to promote vomiting, or even if vomiting has already occurred. Follow with the general irritant-poisoning treatment (p. 212).

249. Q. *What is the special treatment for phosphorus poisoning?*
A. Do not give any oil or fat. After the stomach has been emptied, give Epsom or Glauber's salts. Follow with the general irritant-poisoning treatment (p. 212).

250. Q. *What is the special treatment for silver nitrate poisoning?*
A. Give immediately drinks of strong salt water. Follow with general irritant-poisoning treatment (p. 213).

251. Q. *What are the systemic poisons?*
A. Substances that when swallowed and absorbed affect the body as a whole through their action on the various systems, organs, or tissues. The systemic poisons are divided into two general groups, the depressant poisons and the convulsant poisons (p. 213).

252. Q. *What is a depressant poison?*
A. A depressant poison has a narcotic (sleep-producing) action with progressive lowering of the vital functions of circulation and respiration (p. 213).

253. Q. *What are some of the depressant poisons?*
A. Alcohol in excess, opium and its derivatives, and drugs to produce sleep or relieve pain taken in excess (p. 213).

254. Q. *What are convulsant poisons?*
A. Convulsant poisons are substances whose general action is to produce spasms or convulsions, with rapid paralysis of the vital functions of the circulation or respiration or both (p. 213).

255. Q. *Name some of the more common convulsant poisons.*
A. Nitroglycerin, hydrocyanic acid, the cyanides, and strychnine (p. 216).

256. Q. *What are the symptoms and treatment of alcoholic poisoning?*
A. The symptoms of alcoholic poisoning are the odor of alcohol on the patient's breath and partial or complete unconsciousness, although he usually can be roused temporarily but will relapse into a stupor. There is often muttering delirium. In the early stages, the face is moist and flushed, the pulse is strong, and the breathing is deep. Later, the face becomes dry and bloated, with a bluish cast, the pulse becomes weak and rapid, and the breathing is shallow. The eyes are bloodshot, and the pupils are natural or large but equal in size. When symptoms of alcoholic poisoning are present obtain medical aid promptly. Arouse patient if possible and give salt water, mustard water, or soap and water to promote vomiting. After vomiting, follow by warm black coffee, a cup every 15 minutes. Give aromatic spirits of ammonia. Keep patient warm, and combat physical shock. If respiration becomes very shallow, resort to artificial respiration and oxygen inhalation (p. 214).

257. Q. *What is the cause of food (ptomaine) poisoning?*
A. Foods that have been improperly kept and become decomposed or contaminated by certain types of bacteria. Fish, shellfish, combinations of eggs with milk or cream, and canned foods are the most common sources (p. 218).

258. Q. *What are the symptoms of food poisoning?*
A. Headache, muscular pains, nausea, vomiting, weakness, purging, and, in severe cases, collapse (p. 218).

259. Q. *What is the treatment for food poisoning?*
A. First obtain medical aid. If vomiting has not occurred, promote it by drinks of salt water or mustard water. Keep patient in bed and warm. Give a large dose of castor oil after vomiting has ceased. Stimulate patient with aromatic spirits of ammonia, black coffee, or strong tea. If vomiting persists, give small drinks of soda water (1 teaspoon of baking soda in a glass of water (p. 218).

260. Q. *What causes mushroom poisoning?*
A. Certain varieties of mushrooms are highly poisonous and, if eaten, will cause serious illness and even death (p. 219).

261. Q. *What are the symptoms of mushroom poisoning?*
A. The symptoms of poisoning occur 6 to 12 hours after the mushrooms have been eaten and are headache, nausea, vomiting, pains in the abdomen, and purging. Later, there is great thirst, muscular twitching, a weak, rapid pulse, and cold, clammy skin; patient becomes delirious or goes into a stupor (p. 219).

262. Q. *What is the treatment for mushroom poisoning?*
A. Obtain medical aid at once. Put patient to bed, and keep him warm. Promote vomiting by drinks of salt water or mustard water. Keep patient stimulated by aromatic spirits of ammonia, black coffee, or strong tea. Combat collapse by continued physical shock treatment (p. 219).

263. Q. *Name some of the poisons breathed in with inhaled air.*
A. Dusts of metallic salts, metallic fumes (such as those of lead, mercury, and zinc), poisonous gases, and mists of petroleum products and certain solvents (p. 219).

264. Q. *How are some of the more common poisons injected within the skin?*
A. By bites of rabid animals, bites of poisonous snakes, and bites and stings of insects (p. 220).

265. Q. *What should be done with a suspected rabid animal?*
A. Any animal that has bitten a person and is suspected of being rabid should be confined for at least 30 days for observation to determine whether or not it is suffering from hydrophobia (p. 220).

266. Q. *What first-aid treatment should be used for a bite by a rabid animal?*
A. Wash the wound with grain alcohol to remove saliva if possible. Dress with a sterile bandage compress, and take patient to a physician at once (p. 221).

267. Q. *What are the symptoms of a poisonous snakebite?*
A. A stinging pain and one or two small punctured wounds of the part struck, swelling and discoloration which take place within a very short time, and pain in the region of the bite. If the poison gains entrance to the general system there is great weakness, with nausea, rapid and weak pulse, and, in a few hours, muscular paralysis, and the patient passes into a stupor (p. 221).

268. Q. *What is the treatment for a bite by a poisonous snake?*
A. Keep the patient lying down and quiet, to slow the circulation and retard absorption of the poison. Immediately apply a constricting bandage several inches above the wound between the wound and the heart, to retard the flow of blood in the superficial veins and prevent absorption of the poison. Sterilize an area several inches square around the wound with a

suitable antiseptic. Incise through each wound by means of cuts ⅛ inch deep and ½ inch long in the form of an X. Press the outside of the wounds to make them bleed freely. To promote bleeding, the wound may be sucked and the blood expectorated. Continue the bleeding for 20 minutes, then loosen the constricting bandages for 1 minute. Retighten the constricting bandage, and continue drawing blood from the wound. Additional incisions may be made around the bites if much swelling occurs. Repeat this procedure until medical aid can be obtained. Treat the patient for physical shock from the start (p. 221).

269. Q. *What are the symptoms of bites or stings of insects that cause only local irritation?*

A. Pain in the region stung or bitten, moderate swelling, redness, itching, and burning (p. 222).

270. Q. *What is the treatment for bites and stings of insects that cause only local irritation?*

A. If the sting is left in the wound, withdraw it. Apply by means of a compress a weak ammonia solution (aromatic spirits of ammonia will answer the purpose) or a paste made of baking soda and water. If swelling and pain persist and constitutional symptoms develop, medical care should be obtained (p. 223).

271. Q. *What are the symptoms of bites and stings of insects that cause general symptoms?*

A. Usually one or two small punctures of the skin, local swelling and redness, with a smarting, burning pain. The swelling, redness, and pain increase rapidly, with prostration, sweating, nausea, and pain in the back, shoulders, chest, and limbs developing within a few hours. The constitutional symptoms usually subside within 6 to 12 hours, but occasionally they are severe and end in collapse (p. 223).

272. Q. *What is the treatment for bites and stings of insects that cause general symptoms?*

A. Treat as for the less poisonous bites or stings of insects. Where the swelling and pain are rapid and severe treat as for poisonous snakebite, and obtain medical care as soon as possible. Keep the patient lying down and quiet to retard absorption of the poison into the circulation. Combat physical shock by aromatic spirits of ammonia, black coffee, and strong tea (p. 224).

273. Q. *Name some of the more common poisonings from contact with the skin.*

A. The dermatoses—diseases of the skin and its appendages (the hair follicles, the sebaceous glands, and the sweat glands), causing alteration of the normal structure, irritation, and inflammation; poisoning from poison ivy, poison oak, and poison sumac; and athlete's foot (p. 224).

274. Q. *What are the symptoms of poisoning by poison ivy, poison oak, and poison sumac?*

A. The symptoms of poison ivy, poison oak, or poison sumac poisoning appear on the exposed skin surface, usually the hand, wrist, and arm, 6 hours to several days after exposure. There is a red rash, with some swelling, itching, and burning, followed by the formation of varying-size blisters filled with serum. If the area affected is considerable and the inflammation severe there may be fever, headache, and general body weakness (p. 225).

275. Q. *How may poisoning by poison ivy, poison oak, and poison sumac be avoided?*

A. Some persons are much more susceptible to poison plants than are others and should avoid contact with them as much as possible. When a person must work in the brush where the poisonous plants may occur,

the effects of contact may be prevented by previously coating the hands and arms with a lather made from a strong laundry soap and permitting the lather to dry on the parts. Immediately after such work, wash the hands and arms with the soap and warm water, and again permit the lather to dry. A saturated solution of hyposulphite of soda in water may be used instead of the soap (p. 225).

276. Q. *What is the treatment for poison ivy, poison oak, and poison sumac?*

A. Bathe the inflamed parts with a 5-percent solution of ferric chloride in equal parts of alcohol and water or a solution of hyposulphite of soda, 1 tablespoon to a pint of water. Either solution should be applied with cotton sponges four or five times a day and permitted to dry on the skin. Blisters may be opened with a sterile needle and the serum or pus absorbed on small pads of cotton. Be sure to apply one of the solutions to the part before the blisters are opened immediately after, to prevent spread of the disease. Where the eruption persists, spreads, or is severe, medical attention should be obtained (p. 225).

277. Q. *What is athlete's foot?*

A. An infectious fungus disease of the skin similar to ringworm. Several varieties of fungi are known to cause the disease. The disease may occur on various parts of the body, but occurs most frequently on the feet. The infection is contracted by coming in contact with some object that has been contaminated with the fungus from a preexisting infection (p. 226).

278. Q. *How may athlete's foot be prevented in change houses?*

A. The floors of shower booths should be scrubbed thoroughly with a strong alkali soap and hot water at

least twice each week. After the floor has been scrubbed it should be sprinkled with powdered sodium hyposulfite. It is advisable not to use wooden slat floors in shower booths, but if they are used, they should receive the same care given to floors. A shallow basin about 30 inches long, 24 inches wide, and 3 inches deep should be so placed at the entrance to the shower booth that those entering and leaving the booth will have to step into the basin. A solution of sodium hyposulfite, 1 pound to 8 gallons of water, made fresh each day, should be kept in the basin. Those using the shower should be instructed to stand in the solution several seconds before entering and on leaving the shower. The hyposulfite solution should not be wiped from the feet but allowed to dry on them (p. 226).

279. Q. *What is the treatment for athlete's foot?*

A. Change and wash socks frequently. Soak feet for about 10 minutes night and morning in a solution of sodium hyposulfite made by dissolving 2 tablespoons of sodium hyposulfite in a quart of water. Permit the solution to dry on the feet. A 1-percent solution of sodium hypochlorite may be substituted for the solution of sodium hyposulfite. Dust the feet with a powder made from 1 part of hyposulfite of soda and 4 parts of powdered boric acid before putting on socks. The leather of insoles of shoes affords a medium for the growth of the fungus causing athlete's foot, and reinfections often occur from shoes where the dusting powder is not used regularly. Where the infection is between the toes, they should be kept separated by pads of absorbent cotton well-dusted with the above-mentioned powder. The cotton should be changed daily and that taken out should be burned. If the infection is extensive or does not respond to treatment, medical care should be procured (p. 227).

280. Q. *What is frostbite?*
A. Frostbite is the reaction of parts of the body exposed to severe cold. The nose, cheeks, ears, toes, and fingers are the part most frequently frostbitten. The extent of tissue damage in frostbite is divided into degrees (p. 228).

281. Q. *What are the symptoms of frostbite, by degrees?*
A. The symptoms of frostbite, by degrees, are: In first-degree frostbite, the part is painful and the skin dark red. In second-degree frostbite, the skin is bright red or blue, and blisters form on the surface. In third-degree frostbite, the part is stiff, pale, and brittle (p. 228).

282. Q. *What is the treatment for frostbite, by degrees?*
A. Heat should never be applied immediately to a frostbite, but the temperature should be raised gradually to that of the body. For a first-degree frostbite, cover the part with the hand while in a cool place, and gradually warm to body temperature when the normal circulation is reestablished. If the part cannot be covered by the hands, cloths repeatedly wrung out in water should be placed over it. Start with cool, not ice, water, and gradually increase the temperature of the water, repeating application of the cloths until body temperature is reached. After the part has returned to normal color and circulation has been reestablished, the person may be taken into a heated room (p. 228).

For a second-degree frostbite, treat as for a first-degree frostbite, but raise the temperature of the water in which the cloths are wrung out more gradually. Be gentle in applying the cloths so as not to tear away the skin. About 20 to 30 minutes is required for the treatment before the patient can enter a moderately heated room. When he enters a room, do

not allow the parts to be exposed to direct heat, such as that from a stove or radiator (p. 229).

For third-degree frostbite, treat as for second-degree frostbite, but raise the temperature of the water in which the cloths are wrung out even more gradually, and move the patient first into a slightly heated room and then into a moderately heated room. All frostbites of the second and third degrees should have medical care as promptly as possible (p. 229).

283. Q. *What are the reactions of the body to freezing?*
A. When the entire body is exposed to severe cold, it becomes numb. Exertion is difficult. Eyesight fails. The person so affected totters and falls. Irresistible drowsiness overtakes him, and he becomes unconscious (p. 229).

284. Q. *What is the treatment for freezing?*
A. First obtain medical attention as early as possible. Place the patient in a cool room, well-wrapped in blankets; if breathing has ceased, apply artificial respiration. Rub the limbs under the blanket with a solution of equal parts of alcohol and tepid water. As the patient reacts, the temperature of the room should be raised gradually and the patient given hot drinks of tea, chocolate, or cocoa. Efforts to revive a frozen person should be made for several hours, as persons apparently dead have been restored to life after many hours of treatment (p. 229).

EPILEPSY

285. Q. *What is epilepsy (falling sickness)?*
A. A nervous disease that causes loss of consciousness and convulsive attacks (p. 230).

286. Q. *What are the symptoms of epilepsy?*

A. In epileptic seizure a person often cries out or screams and falls to the ground unconscious. His muscles stiffen, and his head is drawn to one side by convulsive jerks, or there may be convulsive movement of the arms and legs. Breathing ceases for the moment, and the face, which is at first pale, becomes blue. The afflicted person may froth at the mouth. This stage lasts about a minute and is followed by breathing with gradual return of normal color. The eyes, which are open, roll back and forth, and the teeth are clamped shut. The patient may bite his tongue or his cheeks and the froth at the mouth be blood-stained. The bladder and bowels may move involuntarily. This second stage lasts several minutes, then the epileptic slowly regains consciousness and feels very tired. Occasionally epileptic seizures are not recognized, and the sufferer is treated for some other condition and improperly handled. (p. 230).

287. Q. *How should a person in an epileptic seizure be cared for?*

A. He should never be restrained during convulsive movements. See that he does not injure himself by falling into a fire or against any object. Lay the patient on his back on a blanket, with a pad under his head. Cover him to keep him warm. Place a pad between his teeth to prevent biting his tongue or cheeks and, if possible, remove any foreign bodies from his mouth. Loosen tight clothing at neck and waist. Give no stimulant or anything by mouth. Keep the patient at rest after he becomes conscious (p. 230).

TRANSPORTATION OF THE INJURED

288. Q. *What is the sixth fundamental in first aid?*

A. Transportation of the injured (p. 231).

289. Q. *What precautions should be followed before moving an injured person?*
A. Never move an injured person until a thorough examination has been made and his injuries protected by proper dressings (p. 231).
290. Q. *In what position should a seriously injured person be transported?*
A. A seriously injured person should be moved only in a lying position. If means are not immediately at hand for proper transportation of an injured patient, continue your care of the patient to conserve his strength until adequate means of transportation are available (p. 231).
291. Q. *What is the responsibility of a first-aid man in transporting an injured person?*
A. To see that the patient is transported in such a manner as to prevent further injury, not to increase the severity of the original injuries, and that the patient is subjected to no unnecessary pain or discomfort (p. 231).

Have class demonstrate the following methods of transportation:

One-man—assisting to walk.
One-man—carrying in arms.
One-man—dragging patient.
One-man—carrying astride back.
Two-man—assisting to walk.
Two-man—two-handed seat carry.
Two-man—carrying by extremities.
Three-man—lift and carry.

292. Q. *What two general types of stretchers are used in first aid?*
A. The Army type and improvised stretchers (p. 247).
293. Q. *What is the Stokes Navy stretcher and its special use?*
A. A woven wire stretcher similar to a basket, made to conform to the human body. After being strapped in

the basket, the patient may be placed in a vertical position and carried on a mine cage or skip (p. 247).

294. Q. *What are splint stretchers?*
A. Body splints for various injuries that may be used as stretchers as well as splints (p. 247).

295. Q. *What precautions always should be taken before loading a patient on a stretcher?*
A. A stretcher always should be tested by a weight equal to or greater than that of the patient before the injured person is placed on it (p. 249).

296. Q. *In carrying a patient on a stretcher why should the rear man be out of step with the other stretcher bearers?*
A. The rear man breaks step with the other stretcher bearers to prevent swinging of the stretcher and jarring of the patient (p. 261).

297. Q. *On which side is it preferable to lift an injured patient when loading or unloading a stretcher?*
A. It is preferable to lift the patient on the uninjured or least injured side before placing him on or unloading him from a stretcher. There may be exceptions to this rule (p. 255).

Have class prepare an improvised stretcher.
Have class demonstrate stretcher drill:
Fall in.
Count off.
Procure stretcher.
Carry stretcher.
Test stretcher.
Lift patient.
Place stretcher under patient.
Lower patient.
Lift stretcher.
Carry patient.
Lower stretcher.
Unload stretcher.
Cross obstacle.

INDEX

	Page
Abdomen, lower, burns, dressing, view	126
treatment	144
wound, dressing	123
view	126
wound, dressing	123
view	124
Abdominal cavity, contents	39
sketch	38
Abrasions, dangers of infection	99
Acids, corrosive, types	209
Alcoholic poisoning, shock, treatment	214
stimulants, use	214
symptoms	214
treatment	214
Alkalies, corrosive, types	209
Ammonia, effects	63
Amputation, arm, dressing	111
leg, dressing	129
thigh, dressing	129
Anatomy, of human body	31
review questions	274
Ankle, dislocation, dressing, view	192
symptoms	167
treatment	167
fracture, dressing, view	192
symptoms	191
treatment	192
sprained, dressing	150
view	151
wound, dressing	133
view	132

	Page
Aorta, rupture, danger	72
Apoplexy, definition	96
review questions	296
symptoms	97
treatment	97
Arm, amputated, dressing	111
arteries, pressure points, controlling bleeding, directions	81
diagram	71
view	73
burns, dressing, views	41, 141
treatment	140
composite burns, dressing, view	147
treatment	146
lower, fracture, dressing, view	180
treatment	177
of unconscious patient, tying	168
torn from body, dressing	111
tourniquet, application, view	79
upper, fracture, dressing, view	178
treatment	177
wound, dressing	113
views	47, 113
Armpit, wound, dressing	109
view	112
Army stretcher, description	247
view	248
Arseniuretted hydrogen, poisoning, symptoms	212
treatment	212, 220
Arteries, arm, controlling bleeding, directions	81
pressure points, diagram	71
view	73
axillary, pressure point, diagram	71
directions	82
view	74
bleeding from, description	70
brachial, cutting, danger	72
pressure point, diagram	71
directions	82
views	74, 80
carotid, cutting, danger	72
pressure point, diagram	71
directions	71
views	73, 80
course, diagram	71
views	73, 74, 76

	Page
Arteries, facial pressure point, diagram	71
directions	81
view	73
femoral, cutting, danger	72
pressure points, diagram	71
directions	83
views	76, 80
head, pressure points, diagram	71
directions	81
view	73
leg, pressure points, diagram	71
directions	83
view	76
neck, pressure points, diagram	71
directions	81
view	73
popliteal, pressure point, diagram	71
directions	83
view	76
pressure points, control of bleeding at	75
diagram	71
directions	81
views	73, 74, 76
radial, pressure point, diagram	71
directions	82
view	74
subclavian, pressure point, diagram	71
directions	82
view	73
temporal, pressure point, diagram	71
directions	81
views	73, 80
ulnar, pressure point, diagram	71
directions	83
view	74
Artificial respiration, changing operators	57
description	52
oxygen, use to supplement	59
prone-pressure method, description	54
sketch	56
views	55
review questions	280
Schaefer method, description	54
Sylvester method, description	57
views	58

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	Page
Artificial respiration, use	52
in asphyxiation	67
in carbolic acid poisoning	211
in chloral poisoning	216
in convulsant poisoning	217, 218
in cyanide poisoning	217
in drowning	67
in electric shock	61
in gas poisoning	66
in hydrocyanic acid poisoning	217
in lysol poisoning	211
in nitroglycerin poisoning	217
in opium poisoning	215
in poisoning from pain-relieving drugs	216
in poisoning from sleep-producing drugs	216
in strychnine poisoning	218
in suffocation	67
in sulfonal poisoning	216
in trional poisoning	216
in veronal poisoning	216
Asphyxiation, artificial respiration, use	67
treatment	67
Assisting injured person to walk, instructions	236
view	238
Athlete's foot, prevention	226
questions	324
symptoms	226
treatment	227
Axillary artery, pressure point, diagram	71
directions	82
view	74
Back, between shoulders, wound, dressing	120
view	121
broken, dressing, view	189
treatment	188
burns, dressing, views	121, 124, 143
treatment	140
lower, burns, dressing, view	126
treatment	144
wound, dressing	123
view	126
wound, dressing	123
view	124
Backbone, fracture, danger to spinal cord	85

	Page
Bandages, cravat, description	42
view	41
for splints, placing	171
triangular, description	40
use	40
Bandage compress, description	42
view	45
Bandage slings, description	46
views	47
Bandaging, wounds, directions	102
Basilic vein, cutting, danger	72
Bites, of insects, symptoms	222, 223
treatment	223, 224
of poisonous snakes, symptoms	221
treatment	221
of rabid animals, treatment	221
Black widow spider, description	223
stings, symptoms	223
treatment	224
"Bleeders," definition	72
Bleeding, accompanying shock, treatment	91
control, by cold	75
by compress	72
by tourniquet	77
view	79
methods	75
position of patient	74, 75
precautions	74
review questions	287
definition	70
dressings, directions	102
from arteries, control	75
description	70
from capillaries, description	72
from varicose veins, dressing	130
from veins, description	70
internal, control	84
symptoms	84
nose, treatment	107
types	70
Blood, clotting, as safeguard	72
functions	68
loss, fatal amount	72
serious amount	72
review questions	286

	Page
Blood supply, source	68
Blood vessels, functions	68
Body, anatomy	31
review questions	274
composite burns, dressing, view	147
treatment	146
Brachial artery, cutting, danger	72
pressure points, diagram	71
directions	82
views	74, 80
Bruises, definition	146
symptoms	148
treatment	148
Bureau of Mines, duties	xvii
first-aid course, outline	16
requirements	1, 3
first-aid training, cooperative, features	2, 4
splint stretcher, description	206
view	251
Burns, abdomen, lower, dressing view	126
treatment	144
arm, dressing, views	41, 141, 147
treatment	140, 146
back, dressing views	121, 124, 143
lower, dressing, view	126
treatment	144
body, dressing, view	147
treatment	146
buttocks, dressing, view	126
treatment	144
cause	134
chemical, treatment	137
chest, dressing, views	122, 145
treatment	144
composite, dressing, view	147
treatment	146
degrees, explanation	134
dressings	135
extremities, dressing, view	147
treatment	146
eye, by chemicals, dressing, view	106
treatment	137
face, dressing, views	108, 139, 147
treatment	138, 146
first degree, description	134
foot, dressing, view	132
treatment	146

Page

Burns, forearm, dressing, view 142
forearm, dressing, view 142
treatment 140
hand, dressing, view 119
treatment 140
head, dressing, views 108, 139, 147
treatment 138, 146
hip, dressing, view 128
treatment 144
leg, dressing, views 142, 147
treatment 146
oil and grease ointments, avoidance 135
picric-acid gauze, as dressing 135
review questions 300
second degree, description 134
shock with, treatment 135
shoulder, dressing, view 110
treatment 138
thigh, dressing, view 141
treatment 144
third degree, description 135
treatment 135
Buttocks, burns, dressing, view 126
treatment 144
wound, dressing 123
view 126

Cabinets, first aid, contents 11
view 13
Capillaries, bleeding from, description 72
Carbolic acid poisoning, artificial respiration for 211
shock, treatment 211
symptoms 210
treatment 210
Carbon dioxide, effects 62
occurrence 61
Carbon monoxide, effects 64
source 64
Carotid artery, cutting, danger 72
pressure point, diagram 71
directions 81
views 73, 80
Carries, one man, instructions 231
views 232, 234, 235
three man, instructions 241
views 244–246
two man, instructions 236
views 238–240, 242, 243

Page

Carrying, astride back, instructions 233
view 237
by extremities, instructions 236
views 242, 243
in arms, instructions 233
view 232
Centipedes, stings, symptoms 223
treatment 224
Cephalic vein, cutting, danger 72
Cerebral hemorrhage, definition 96
symptoms 97
treatment 97
Cerebrospinal system, functions 84
Changing operators, in artificial respiration 57
Cheekbone, fracture, dressing, view 105
treatment 173
Chemical burns, of eye, treatment 137
treatment 137
Chest, between shoulders, wound, dressing 120
view 122
burns, dressing, views 122, 145
treatment 144
wound, dressing 123
view 124
Chest cavity, contents 37
sketch 38
Chin, wound, dressing 108
view 107
Chloral poisoning, artificial respiration, use 216
stimulant, use 216
symptoms 215
treatment 216
Circulatory system, description 68
questions 286
sketch 69
Clotting, of blood, as safeguard 72
Cold, use, to control bleeding 75
Collarbone, fracture, dressing, views 174
symptoms 173
treatment 174
Compress, bandage, description 42
view 45
use, to stop bleeding 72
Convulsant poisoning, artificial respiration, use 217, 218
stimulants, avoidance 218
use 217

	Page
Convulsant poisoning, symptoms	216, 217
treatment	217, 218
types	216
Copper poisoning, treatment	212
Corrosive poisoning, effects	209
symptoms	209
treatment	210
types	209
Cramps, heat, definition	94
prevention	95
review questions	295
symptoms	94
Cravat bandages, description	42
use, as tourniquet	78
view	41
Cravat bandage sling, description	46
view	47
Crotch, wound, dressing	125
views	127
Crushing, fingers, bones, dressing, view	182
treatment	179
foot, bones, dressing, view	196
treatment	195
toe, bones, dressing, view	196
treatment	195
Cyanide poisoning, artificial respiration, use	217
stimulants, use	217
symptoms	217
treatment	217
Cyanogen gas compounds, effects	65
Depressant poisons, types	213
Dislocations, ankle, dressing, view	192
symptoms	167
treatment	167
definition	156
elbow, dressing, views	163, 164, 177
symptoms	160
treatment	160
finger, symptoms	162
treatment	162
hip, dressing, views	166, 168, 188
symptoms	165
treatment	165
jaw, dressing, views	159
reduction	157
symptoms	157

	Page
Dislocation, knee, dressing, view	192
symptoms	167
treatment	167
kneecap, dressing, view	192
symptoms	167
treatment	167
review questions	308
shoulder, dressing, views	161
symptoms	158
treatment	160
symptoms	157
toe, symptoms	169
treatment	169
treatment	157
wrist, dressing, views	47
symptoms	162
treatment	162
Dressings, first aid, description	40
review questions	276
for bleeding, directions	102
for burns, directions	135
for scalds, directions	135
for wounds, instructions	102
Dressing station, first aid, equipment	11
view	10
Drowning, artificial respiration, use	67
treatment	67
Ear, foreign bodies, treatment	154
wounds, dressing	104
view	105
Elbow, dislocation, dressing, views	163, 164, 177
symptoms	160
treatment	160
fracture, dressing, view	180
treatment	177
wound, dressing	114
views	47, 115
Electric shock, artificial respiration, use	61
review questions	285
symptoms	60
treatment	60
Emergency hospital, surface, equipment	12
view	14
Epiglottis, functions	48
sketch	49

	Page
Epilepsy, review questions	327
stimulant, avoidance	231
symptoms	230
treatment	230
Excretory systems, functions	39
Exhaustion, heat, definition	93
review questions	294
symptoms	94
treatment	94
Extremities, composite burns, dressing, view	147
treatment	146
description	35
long bones, fracture, splints for, fixed traction	196
advantages	197
views	199, 200, 203, 205
lower, fracture, dressings, views	192, 194, 196
splints for, fixed traction	201
views	203, 205
symptoms	191
treatment	191
upper, fracture, splints for, fixed traction	197
views	199, 200
dressings, views	178, 180, 182
fractures, symptoms	177
treatment	177
Eye, burns, by chemicals, dressing, view	106
treatment	137
foreign bodies, dressing, views	106, 154
treatment	153
injuries, dressing	104
view	106
Face, burns, dressing, views	108, 139
treatment	138
composite burns, dressing, view	147
treatment	146
wounds, dressing	104
view	105
Facial artery, pressure point, diagram	71
directions	81
view	73
Fainting, definition	92
review questions	294
symptoms	92
treatment	93

	Page
Femoral artery, cutting, danger	72
pressure points, diagram	71
directions	83
views	76, 80
Femoral vein, cutting, danger	72
Finger, bones, crushing, dressing, view	182
treatment	179
fracture, dressing, view	182
treatment	179
dislocation, symptoms	162
treatment	162
end, wound, dressing	118
views	47, 119, 121
fracture, treatment	181
wound, dressing	118
views	47, 121
Firedamp, characteristics	61
First aid, definition	6
general directions	15
limitations	7
objects	7
value to employees	7
value to employers	8
First-aid cabinets, contents	11
view	13
First-aid classes, cooperative, examination	5
First-aid course, outline	16
requirements	1, 3
First-aid dressing station, equipment	11
view	10
First-aid instructor, permanent, certificates	5
provisional, card certificate, renewal	5
requirements	4
First-aid organization, features	9
First-aid training, cooperative, features	2, 4
one-hundred-percent cooperative	8
First-degree burns, description	134
Fixed traction, use, in splinting fractures of extremities	196
Food poisoning, cause	218
questions	320
stimulants, use	218
symptoms	218
treatment	218
Foot, bones, crushing, dressing, view	196
treatment	195
fracture, dressing, view	196
treatment	195

	Page
Foot, burns, dressing, view	132
treatment	146
wound, dressings	133
views	132
Forearm, burns, dressing, view	142
treatment	140
fracture, dressing, view	180
treatment	177
wound, dressing	114
views	47, 115
Forehead, wounds, dressing	104
view	106
Foreign bodies, in ear, treatment	154
in eye, treatment	153
in nose, treatment	155
in stomach, treatment	156
in throat, treatment	155
in windpipe, treatment	155
Fractures, ankle, dressing, view	192
symptoms	191
treatment	193
application of splints	171
arm, lower, dressing, view	180
treatment	177
upper, dressing, view	178
treatment	177
cheekbone, dressing, view	105
treatment	173
collarbone, dressing, views	175
symptoms	173
treatment	174
compound, definition	169
use of tourniquet	78
elbow, dressing, view	180
treatment	177
extremities, long bones, splints for, fixed traction	196
advantages	197
views	199, 200, 203, 205
lower, dressings, views	192, 194, 196
splints for, fixed traction	201
views	203, 205
symptoms	191
treatment	191
upper, splints for, fixed traction	197
views	199, 200
symptoms	177
treatment	177

	Page
Fractures, fingers, bones, dressing, view	182
treatment	179, 181
foot, bones, dressing, view	196
treatment	195
forearm, dressing, view	180
treatment	177
handling, care	169
hip, dressing, views	192
symptoms	190
treatment	190
jaw, dressing, views	159
symptoms	173
treatment	173
knee, dressing, view	192
symptoms	193
treatment	193
kneecap, dressing, view	194
treatment	193
leg, dressing, view	194
treatment	195
neck, dressing, views	187
treatment	186
nose, bandage, view	107
dressing	172
view	107
symptoms	172
treatment	173
pelvis, dressing, views	192
symptoms	190
treatment	190
review questions	309
rib, dressing, view	184
treatment	181
shoulder blade, dressing, view	176
symptoms	174
treatment	174
simple, definition	169
skull, danger to nerve tissue	85
definition	172
stimulants, avoidance	172
symptoms	172
treatment	172
spine, danger to spinal cord	85
dressing, view	189
treatment	188

	Page
Fractures, symptoms	170
thigh, dressing, view	192
symptoms	191
treatment	193
toe, bones, dressing, view	196
treatment	195
treatment	170
wrist, dressing, view	180
treatment	177
Freezing, symptoms	229
treatment	229
Frostbite, degrees, definition	228
questions	326
treatment	228
Gases, dangerous, effects	61
review questions	285
Gas poisoning, prevention	66
review questions	285
treatment	66
Gauze, uses	44
Grease, avoidance, in treatment of burns	135
Groin, wound, dressing	125
view	126
Hand, back, wound, dressing	116
views	47, 117
bones, crushing, dressing, view	182
treatment	179
fracture, dressing, view	182
treatment	179
burns, dressing, view	119
treatment	140
extensive wounds, dressing	116
views	47, 119
palm, wound, dressing	116
views	47, 117
Head, arteries, pressure points, diagram	71
directions	81
view	73
back of, wounds, dressing	104
burns, dressing, views	108, 139
treatment	138
composite burns, dressing, view	147
treatment	146
description	33
Heart, functions	68

	Page
Heat cramps, definition	94
prevention	95
review questions	295
symptoms	94
Heat exhaustion, definition	93
review questions	294
symptoms	94
treatment	94
Hemorrhage, accompanying shock, treatment	91
cerebral, definition	96
symptoms	97
treatment	97
control, methods	75
review questions	287
definition	70
internal, control	84
symptoms	84
types	70
Hernia, definition	150
dressing, view	152
symptoms	150
treatment	151
Hip, burns, dressing, view	128
treatment	144
dislocation, dressing, views	166, 168
symptoms	165
treatment	165
fracture, dressing, views	192
symptoms	190
treatment	190
wound, dressing	125
view	128
Holmes Safety Association chapters, work in first aid	9
Homestake splint stretcher, view	251
Hospital, emergency, on surface, equipment	12
view	14
Hydrocyanic acid poisoning, artificial respiration, use	217
stimulants, use	217
symptoms	217
treatment	217, 220
Hydrogen cyanide gas, effects	65
Hydrogen sulfide, effects	63
source	63
Hydrophobia, in animals, symptoms	220

	Page
Incised wounds, dangers of infection	99
Infection, definition	98
review questions	296
Inhaled poisons, symptoms	219
treatment	219
Injected poisons, shock, treatment	222
symptoms	220, 221, 222, 223
treatment	221, 223
Injured person, moving, by another, instructions	233
views	234, 235
danger	15
preliminary examination	15
Insects, bites, shock, treatment for	224
stimulants, use	224
symptoms	222, 223
treatment	223, 224
stings, shock, treatment for	224
stimulants, use	224
symptoms	222, 223
treatment	223, 224
Instructor, permanent first aid, certificates	5
provisional first-aid, card certificate, renewal	5
requirements	4
Iodine poisoning, treatment	212
Irritant poisoning, symptoms	212
treatment	212
types	211
Ivy, poison, poisoning by, symptoms	224
treatment	225
Jarrett splint stretcher, view	252
Jaw, lower, dislocation, dressing, views	159
reduction	157
symptoms	157
fracture, dressing, view	159
symptoms	173
treatment	173
upper, fracture, dressing, view	105
treatment	173
Joints, definition	35
Jugular vein, cutting, danger	72
Knee, dislocation, dressing, view	192
symptoms	167
treatment	167

	Page
Knee, fracture, dressing, view	192
fracture, dressing, view	192
symptoms	191
treatment	193
wound, dressing	130
view	129
Kneecap, dislocation, dressing, view	192
symptoms	167
treatment	167
fracture, dressing, view	194
treatment	193
Lacerated wounds, dangers of infection	100
Leg, amputated, dressing	129
arteries, pressure points, diagram	71
directions	83
view	76
burns, dressing, view	142
treatment	146
composite burns, dressing, view	147
treatment	146
fracture, dressing, view	194
treatment	195
varicose veins, bleeding, dressing	130
view	131
wound, dressing	130
view	131
Loop, use, with splint bandages	171
Lungs, description	50
sketch	51
purification of blood by	70
diagram	69
Lysol poisoning, artificial respiration for	211
shock with, treatment	211
symptoms	210
treatment	210
"Mad" animals, bites of, treatment	221
Mercury poisoning, treatment	212
Methane, characteristics	61
Moving, injured persons, danger	15
Muscles, definition	37
sketch	36
Mushroom poisoning, cause	219
review questions	320
stimulants, use	219
symptoms	219
treatment	219

	Page
Neck, arteries, pressure points, diagram	71
directions	81
view	73
broken, dressing, view	187
treatment	185
burns, dressing, views	108, 139
treatment	138
composite burns, dressing, view	147
treatment	146
wound, dressing	109
view	108
Nervous system, functions	84
review questions	291
sympathetic, functions	85
Nitrogen oxides, effects	63
source	63
Nitroglycerin poisoning, artificial respiration, use	217
stimulants, use	217
symptoms	216
treatment	217
Nose, bleeding, treatment	107
foreign bodies, treatment	155
fracture, bandage, view	107
dressing	172
view	107
symptoms	172
treatment	173
functions	48
sketch	49
wound, dressing	107
view	107
Oak, poison, poisoning by, symptoms	224
treatment	225
Oils, avoidance, in treatment of burns	135
One-man carry, instructions	231
views	232, 234, 285
Opium derivatives. *See* Opium.	
Opium poisoning, artificial respiration, use	215
stimulant, use	215
symptoms	215
treatment	215
Organization, first aid, features	9
Oxygen, administering, to supplement artificial respiration	59

768735 O—48——24

Page

Pain-relieving drugs, poisoning from, artificial respiration, use 216
stimulants, use 216
symptoms 215
treatment 216
Pelvis, description 34
fracture, dressing, views 192
symptoms 190
treatment 190
sketch 34
Phosphorus poisoning, treatment 212
Picric-acid gauze, as dressing for burns 135
uses 44
Poisoning, alcoholic, shock, treatment 214
stimulants, use 214
symptoms 214
treatment 214
by mouth, types 209, 211, 213
by pain-relieving drugs, artificial respiration, use 216
stimulants, use 216
symptoms 215
treatment 216
by sleep-producing drugs, artificial respiration, use 216
stimulants, use 216
symptoms 215
treatment 216
carbolic acid, artificial respiration, use 211
shock with, treatment 211
symptoms 210
treatment 210
chloral, artificial respiration, use 216
stimulants, use 216
symptoms 215
treatment 216
convulsant, artificial respiration, use 217, 218
stimulants, avoidance 218
use 217
symptoms 216, 217
treatment 217, 218
types 216
copper, treatment 212
corrosive, effects 209
symptoms 209
treatment 210
types 209

	Page
Poisoning, cyanide, artificial respiration, use	217
stimulants, use	217
symptoms	217
treatment	217
depressant, types	213
effect on human body	207
gas, prevention	66
review questions	285
treatment	66
food, cause	218
review questions	320
stimulants, use	218
symptoms	218
treatment	218
hydrocyanic acid, artificial respiration, use	217
stimulants, use	217
symptoms	217
treatment	217, 220
inhaled, symptoms	219
treatment	219
injected under skin, shock, treatment	222
symptoms	220, 221, 222, 223
treatment	221, 223
iodine, treatment	212
irritant, symptoms	212
treatment	212
types	211
lysol, artificial respiration for	211
shock with, treatment	211
symptoms	210
treatment	210
mercury, treatment	212
mushroom, cause	219
review questions	320
stimulants, use	219
symptoms	219
treatment	219
nitroglycerin, artificial respiration, use	217
stimulants, use	217
symptoms	216
treatment	217
opium, artificial respiration, use	215
stimulant, use	215
symptoms	215
treatment	215
phosphorus, treatment	212

	Page
Poisoning, poison ivy, symptoms	224
treatment	225
poison oak, symptoms	224
treatment	225
poison sumac, symptoms	224
treatment	225
prevention	208
ptomaine, cause	218
review questions	320
stimulants, use	218
symptoms	218
treatment	218
review questions	315
silver nitrate, treatment	213
strychnine, artificial respiration, use	218
stimulants, avoidance	218
symptoms	217
treatment	218
sulfonal, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	216
systemic, symptoms	213
types	213, 216
trional, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	216
veronal, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	216
Poison ivy, poisoning by, symptoms	224
treatment	225
Poison oak, poisoning by, symptoms	224
treatment	225
Poison sumac, poisoning by, symptoms	224
treatment	225
Popliteal artery, pressure point, diagram	71
directions	83
view	76
Portable splint stretcher, view	252
Position, use, to control bleeding	75
Pressure, use, to control bleeding	75

	Page
Pressure points, of arteries, control of bleeding at	75
diagram	71
directions	81
number	75
views	73, 74, 76
Prone-pressure method, artificial respiration, description	54
sketch	56
views	55
Ptomaine poisoning, cause	218
questions	320
stimulants, use	218
symptoms	218
treatment	218
Punctured wounds, dangers of infection	100
Rabid animals, bites, treatment	221
Rabies, in animals, symptoms	220
Radial artery, pressure point, diagram	71
directions	82
view	74
Reef knot, directions	42
view	43
Respiration, artificial, description	52
changing operators	57
oxygen, use to supplement	59
prone-pressure method, description	54
sketch	56
views	55
review questions	280
Schaefer method. *See* Prone-pressure method.	
Sylvester method, description	57
views	58
uses	52
in asphyxiation	67
in carbolic acid poisoning	211
in chloral poisoning	216
in convulsant poisoning	217, 218
in cyanide poisoning	217
in drowning	67
in electric shock	61
in gas poisoning	66
in hydrocyanic acid poisoning	217
in lysol poisoning	211
in nitroglycerin poisoning	217
in opium poisoning	215
in poisoning from pain-relieving drugs	216

	Page
Respiration, artificial, uses, in poisoning from sleep-producing drugs	216
in strychnine poisoning	218
in suffocation	67
in sulfonal poisoning	216
in trional poisoning	216
in veronal poisoning	216
definition	48
review questions	277
Rib, fracture, dressing, view	184
treatment	181
Rupture, definition	150
dressing, view	152
symptoms	150
treatment	151
St. John's tie, use, with splint bandages	171
Scalds, cause	134
composite, dressing, view	147
treatment	146
degrees, explanation	134
dressings	135
oil and grease, avoidance	135
questions	300
shock	135
treatment	135
Scalp, wounds, dressing	102
views	103, 105
Schaefer method, artificial respiration, description	54
operators, changing	57
questions	281
sketch	56
views	55
Scorpions, stings, symptoms	223
treatment	224
Second-degree burns, description	134
Shock, blue, treatment	92
electric, artificial respiration, use	61
review questions	285
symptoms	60
treatment	60
physical, causes	86
definition	86
review questions	292
symptoms	86
treatment	88
red. treatment	91

	Page
Shock, treatment for, in alcoholic poisoning	214
in bites of poisonous insects	224
in carbolic acid poisoning	211
in corrosive poisoning	209, 210
in snakebite	222
with burns and scalds	135
white, treatment	92
Shoulder, burns, dressing, view	110
treatment	138
dislocation, dressing, views	161
symptoms	158
treatment	160
wound, dressing	109
view	110
Shoulder blade, fracture, dressing, view	176
symptoms	174
treatment	174
Side, wound, dressing	123
view	124
Silver nitrate poisoning, treatment	213
Skeleton, description	31
review questions	274
sketch	32
Skin, functions	37, 97
Skull, description	33
fracture, danger to nerve tissue	85
definition	172
stimulants, avoidance	172
symptoms	172
treatment	172
Sleep-producing drugs, poisoning from, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	215
Slings, uses	46
Snakes, poisonous, bites, symptoms	221
treatment	221
kinds	221
Spiders, stings, symptoms	223
treatment	224
Spine, fracture, danger to spinal cord	85
treatment	183
sketch	33
Splints, application, to fractures	171
bandages for, placing	171
Thomas type	198, 201
uses	44

	Page
Splint stretcher, Bureau of Mines, description	206
view	251
views	251, 252
Sprains, ankle, dressing	150
view	151
definition	149
symptoms	149
treatment	149
Square knot, directions	42
view	43
Sterile gauze, uses	44
Stimulants, avoidance, in apoplexy	97
in bleeding	74
in convulsant poisoning	218
in epilepsy	231
in fracture of skull	172
in strychnine poisoning	218
in sunstroke	96
use, after artificial respiration	56
in alcoholic poisoning	214
in chloral poisoning	216
in convulsant poisoning	217
in cyanide poisoning	217
in fainting	93
in food poisoning	218
in heat exhaustion	94
in hydrocyanic acid poisoning	217
in mushroom poisoning	219
in nitroglycerin poisoning	217
in opium poisoning	215
in poisoning from pain-relieving drugs	216
in poisoning from sleep-producing drugs	216
in shock	89
in sulfonal poisoning	216
in treatment of bites of poisonous insects	224
in trional poisoning	216
in veronal poisoning	216
Stings, of insects, symptoms	222, 223
treatment	223, 224
Stokes Navy stretcher, description	247
view	248
Stomach, foreign bodies, treatment	156
Strains, definition	148
symptoms	148
treatment	148

	Page
Stretchers, improvised, instructions	247
view	249, 250
splint, Bureau of Mines, description	206
view	251
types, description	247
views	248
Stretcher drill, diagram	266
instructions	253
views	254, 256, 258–260, 262, 263, 265
Stretcher transportation, instructions	249
Stroke, definition	96
symptoms	97
treatment	97
Strychnine poisoning, artificial respiration, use	218
stimulants, avoidance	218
symptoms	217
treatment	218
Subclavian artery, pressure point, diagram	71
directions	82
view	73
Suffocation, artificial respiration, use	67
treatment	67
Sulfonal poisoning, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	216
Sulfur dioxide, effects	62
source	62
Sumac, poison, poisoning by, symptoms	224
treatment	225
Sunstroke, definition	95
review questions	295
symptoms	95
treatment	96
Sylvester method, artificial respiration, description	57
questions	283
views	58
Sympathetic nervous system, functions	85
Systemic poisons, symptoms	213
types	213, 216
Tannic acid, as dressing for burns	136
Tarantulas, stings, symptoms	223
treatment	224
Temple, wounds, dressing	104
view	105

Page

Temporal artery, pressure point, diagram 71
directions 81
views 73, 80
Tendons, definition 37
Thigh, amputated, dressing 129
burns, dressing, view 141
treatment 144
fracture, dressing, view 192
symptoms 191
treatment 193
wound, dressing 128
view 128
Third-degree burns, description 135
Thomas-type splints, description 198, 201
Three-man carry, instructions 241
views 244–246
Throat, description 48
sketch 49
foreign bodies, treatment 155
wound, dressing 109
view 108
Toe, bones, crushing, dressing, view 196
treatment 195
fracture, dressing, view 196
treatment 195
dislocation, symptoms 169
treatment 169
end, dressing 134
views 121, 132
wound, dressing 133
Tourniquets, construction 48
control of bleeding by 77
uses 48
in compound fractures 78, 170
Traction, fixed, use, in splinting fractures of extremities 196
Transportation, of injured, by stretcher, instructions 249
instructions 231
questions 328
sketch 266
views 232, 234, 235, 237–240, 242–246, 248–252, 254, 256, 258–260, 262, 263, 265
Triangular bandages, description 40

	Page
Triangular bandage sling, description	46
view	47
Trional poisoning, artificial respiration, use	216
stimulants, use	216
symptoms	215
treatment	216
Trunk, description	34
Two-handed seat carry, instructions	236
views	239, 240
Two-man carry, instructions	236
views	238–240, 242, 243
Ulnar artery, pressure point, diagram	71
directions	83
view	74
Unconscious person, moving, by another, instructions	233
views	234, 235
Varicose veins, bleeding, dressing	130
view	131
Veins, bleeding from, description	70
varicose, bleeding, dressing	130
view	131
Vena cava, rupture, danger	72
Veronal poisoning, artificial respiration, use	216
stimulant, use	216
symptoms	215
treatment	216
Vertebrae, section, sketch	33
Windpipe, foreign bodies, treatment	155
Wounds, abdomen, dressing	123
views	124, 126
ankle, dressing	133
view	132
arm, dressing	113
views	47, 113
armpit, dressing	109
view	112
back, between shoulders, dressing	120
view	121
dressing	123
views	124, 126
bandaging	102

	Page
wounds, buttocks, dressing	123
view	126
chest, between shoulders, dressing	120
view	122
dressing	123
view	124
chin, dressing	108
view	107
closed, definitions	146
review questions	303
treatment	146
crotch, dressing	125
views	127
dressings, directions	102
ear, dressing	104
view	105
elbow, dressing	114
views	47, 115
face, dressing	104
view	105
finger, dressing	118
views	47, 119, 121
foot, dressings	133
views	132
forearm, dressing	114
views	47, 115
forehead, dressing	104
view	106
groin, dressing	125
view	126
hand, dressings	116
views	47, 117, 119
head, dressing	104
hip, dressing	125
view	128
incised, dangers of infection	99
knee, dressing	130
view	129
lacerated, dangers of infection	100
leg, dressing	130
view	131
neck, dressing	109
view	108
nose, dressing	107
view	107

	Page
Wounds, open, care	100
infection, dangers	98
precautions	101
punctured, dangers of infection	100
review questions	297
scalp, dressing	102
views	103, 105
shoulder, dressing	109
view	110
thigh, dressing	128
view	128
side, dressing	123
view	124
temple, dressing	104
view	105
throat, dressing	109
view	108
toe, dressing	133, 134
views	121, 132
wrist, dressing	114
views	47, 115
Wrist, dislocation, dressing, views	47
symptoms	162
treatment	162
fracture, dressing, view	180
treatment	177
wound, dressing	114
views	47, 115

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